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ABSTRACT

Part of a sequential series of curriculum units in environmental education for grades 4 through 12, this curriculum guide focuses on environmental problems in the United States for eleventh grade students. This unit is designed to make the student aware of how the problems of the past become critical problems of the present. Activities foster an examination of population, technology, pollution, environmental careers, and involvement in an urban encounter field trip. The unit includes an overview, major concepts, behavioral objectives, a daily schedule, lesson plans for classroom activities and the field trip, career opportunities in environmental education, pretest and posttest, and student and teacher evaluation. The unit is three weeks long, multidisciplinary in nature, and structured around student-centered activities in which emphasis is placed upon the study of the local environment. (Author/JR)

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LITTLE ROCK ENVIRONMENTAL EDUCATION PROJECT

"A Multidisciplinary and Direct Experience Approach to Teaching Environmental Education"

The Little Rock Environmental Education Project is a Title III ESEA project designed to develop a sequential series of curriculum units in environmental education for grades 4 through 12. Emphasis will be placed upon a different area of environmental education in each curriculum unit as shown below.

GRADE	ENVIRONMENTAL UNIT
4	Nature of the Environment
5	Interaction in the Environment
6	Man's Effects upon the Environment
*7	Types of Environments
*8	Types of Pollution
*9	Local and State Environmental Problems
10	Ecology
11	U. S. Environmental Problems
12	Science and Survival

* Will not be implemented until the 1974-75 school year.

Each curriculum unit, which will require three weeks of class time, will be multidisciplinary in nature and will be structured around student-centered activities in which emphasis will be placed upon the study of the local environment. One off-campus field trip will be included in each unit. Each curriculum unit will include the following components: (a) an overview of the unit, (b) the major concepts in the unit, (c) the behavioral objectives for the unit, (d) a daily schedule for the unit, (e) lesson plans for classroom activities and the field trip, (f) career opportunities in environmental education (g) pre-test and post test for unit, and (h) student and teacher evaluations of the unit.

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TEACHER'S GUIDE

ENVIRONMENTAL EDUCATION UNIT

ELEVENTH GRADE AMERICAN HISTORY

ENVIRONMENTAL PROBLEMS OF THE UNITED STATES

LITTLE ROCK SCHOOL DISTRICT
ENVIRONMENTAL EDUCATION PROJECT
ESEA - TITLE III 1973-74

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OVERVIEW OF UNIT

This three week unit is designed to make the student aware of how the problems of the past became the critical problems of the present. Unless an informed public organizes and becomes stewards of the environment, today's problems can only lead to disaster in the future.

It is imperative that each student feel a sense of responsibility for his environment. The topics for this unit introduce the student to conditions existing in his nation and his community. He will study how the increase in population and the advances in technology have contributed to the ever increasing pollution problems. He will study how our limited supply of natural resources are being used and missused and realize his own responsibility in preserving restoring and using the environment wisely. Old careers dealing with the environment are being reidentified and new careers in this field are emerging. The student will explore some of the different types of careers that deal with the environment and the job opportunities in each.

To arouse the interest and concern of the students in these problems, they must be made aware that the threats are serious, the losses are critical, and the need for action is urgent. Student pleas for relevancy in education can be dramatically satisfied in these lessons. What can be more relevant than their personal survival? Students must realize that there are differences of opinion on most environmental subjects therefore materials showing different views will be presented. Because of these contradictive points of view, the student will realize there are no easy answers to environmental problems.

Films, filmstrips, games and other resource materials will be available for this study. During the unit one three-hour Urban Encounter field trip has been planned as well as one three-hour careers conference day.

MAJOR CONCEPTS IN UNIT

1. Our earth is threatened and challenged by our rapidly increasing human population. The most common result of overpopulation is that there are too many people for the available resources.

2. Technology, the application of scientific knowledge to supply the material needs of people, is a major factor in our lives. It has solved many problems but has also created many others.

3. Pollution is the unfavorable change in our environment. It is caused wholly, or largely as a by-product of man's actions.

4. Natural resources are the natural wealth of a country (air, land, forests, minerals, water, etc.)

5. All natural resources are finite.

6. The complex problems facing us cannot be handled without a sufficient number of trained scientists, technicians, engineers and social scientists who have the knowledge and skills necessary for restoring and maintaining a desirable environment.

7. Individual acts must not violate the rights of nature or man in order to improve the quality of life for us and future generations.

OVERALL BEHAVIORAL OBJECTIVES FOR UNIT

Cognitive:

The student will recognize the inherent threat to the world's continued existence due to the rapidly increasing population and decreasing available resources, as measured by teacher made test, standardized test, and small group research activites.

The student will analyze the effects of technological development upon man and the environment as measured by teacher observation, teacher made tests, field trips and research questions.

The student will analyze the increasing effects of pollution upon man and the environment as measured by teacher observation, teacher made tests, field trips and research problems.

The student will analyze the development of the country through the use and misuse of natural resources as measured by teacher observation, teacher made tests and field trips.

The student will analyze the growing need for sufficient number of trained personnel to solve environmental problems and to restore and maintain environmental quality as measured by teacher made tests, maps, charts, graphs and participation in a careers conference day.

The student will understand the physical and social responsibility he bears for the restoration, preservation and wise use of the environment.

Affective:

The student will value his knowledge of environmental problems as measured by teacher observation of participation in indivdual or group projects.

The student will demonstrate his awareness of the need for restoration and preservation and wise use of the environment as measured by his attitudes and actions on campus.

Suggested Procedures for Teaching Unit

1. Organize your class into three main study groups: Population, Technology and Pollution. It will be necessary to further divide each of these groups into three smaller groups. Each of these subgroups will explore a different area of the main topic.

2. Distribute the student studies and explain the purpose of the three week unit. Have the resource materials out so the students may see and use them.

3. The resource materials are to used within the class period. If they are checked out overnight be sure that they are returned to you before the first period class the next day.

4. Each suudent will participate in a three hour Urban Encounter. This field trip will come during the second week of the study. You will receive the field trip schedule for your classes before the unit starts at your school.

5. Assign each student to be responsible for one part of the Urban Encounter Guide.

6. During the third week of study, one day has been set aside as Careers Conference Day. Each student will take part in the three hour conference. He will receive four copies of the Environmental Occupational Analysis Guide to be completed for each career speaker.

7. For the showing of the films, Population and the American Youth (60 minutes) and Beer Can By the Highway and People Who Fight Pollution (50 minutes) all classes meeting at the same hour will report to a designated place and roll will be checked there.

8. The other two films will be rotated among the classes. They are short enough that perhaps two teachers will be able to use them in one class period.

9. The Red wood controversy game is to be assigned to your students. It will be in the schedule for the first week. Since each teacher will have only one game for all of their classes, the class presentation will vary during the three week unit. To get things moving it would be adviseable to assign the Redwood Controversy to Period 1 on the first day for presentation in class on Day 2. Then when Period 2 meets the second day you can assign the Redwood Controversy for presentation on Day 3, etc. The game will be great for motivational purposes but its effectiveness will not be lost even if it has be to presented during the second week.

10. Check out ten copies of the text Problems of Democracy by William E. Dunwiddie from your department chairman. These books are needed for student resource material during the unit.

11. When working with your basic classes, it would probably be desirable to have two days each for teacher-led discussion on population, technology, and pollution and then, have one day for student presentation.

SCHEDULE FOR UNIT

DAY	ACTIVITY
1	(1) Give Pre-Test. (2) Distribute and give instructions for student study sheets.
2 & 3	Teachers may choose from the following activities: (1) Student research on environmental problems. (2) Show the film Environment. (3) Play "The Redwood Controversy" game.
4	Show the film Population and the American Youth.
5	(1) Discussion of Population and the American Youth film. (2) Student research on environmental problems.
6	Student research on environmental problems.
7	Student research on environmental problems.
8	(1) Show film Clean Town USA or Cycles. (2) Student research on environmental problems.
9	(1) Show film People Who Fight Pollution. (2) Show filmstrip Beer Can by the Highway.
10	Urban Encounter Field Trip. (The field trip will be scheduled during the second week of the unit. Therefore, individual class schedules will have to be adjusted depending upon the day that the class takes the field trip.)
11	Student presentations on environmental problems.
12	Student presentations on environmental problems.
13	Careers Day Conference (3 hours).
14	Review of the unit.
15	(1) Give Post Test. (2) Student evaluation of the unit.

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Background Information: Population, Technology, and Pollution

Ralph Waldo Emerson, writing more than a centruy ago, succinctly predicted the present environmental crisis. "The end of the world will be that it will eventually die of civilization."

The ever increasing world population problem is one of the great concerns of our day. Population growth must be controlled if people are to lead a decent life. We must stop any further increase in population and, if possible, reduce it. The urgency is immediate because the quality of the environment is imperiled, out cities may become unhabitable, our countryside may be irretrievably blighted, and our survival as a race with any source of dignity is threatened. The chances for present and future generations to enjoy "the good life" depends on the interplay of population size and the rate of consumption of land, air, water and minerals and the use that is made of resources consumed.

As population increased, man's role shifted from food gatherer to agriculturist, and finally to technological man. Industrialization expanded in the United States after 1850 because of the available natural resources and the favorable political climate. The crux of the matter is that "progress" - our technology and vast output of goods and services - produces in increasing quanities the wastes that cause the pollution which threaten us. Our dilemma is whether technological growth can be maintained without irreversibly polluting and depleting the resources upon which development and growth depend.

Uncontrolled population increase and unchecked technological growth have caused pollution which is the great concern of our day. Pollution is caused by people consuming resources and in this process turning them into waste. A major concern for today is the great increases in the pollution of our water, air, and land. The problems of pollution are so pervasive, so intricately interrelated, so quickly bringing us to points of no return in damage to the environment, that perhaps no solution can be found in time to save us from disaster. But Senator Gaylor Nelson, writing as an inhabitant of this overcrowded, polluted "Spaceship Earth" gives those who are apprehensive about the future some hope when he said, "We are evolving a new ethic. No longer do we consider ourselves separate form the environment or above it. We realize that we are part of it, that we and nature are interdependent and that whatever affects the environment sooner or later effects man."

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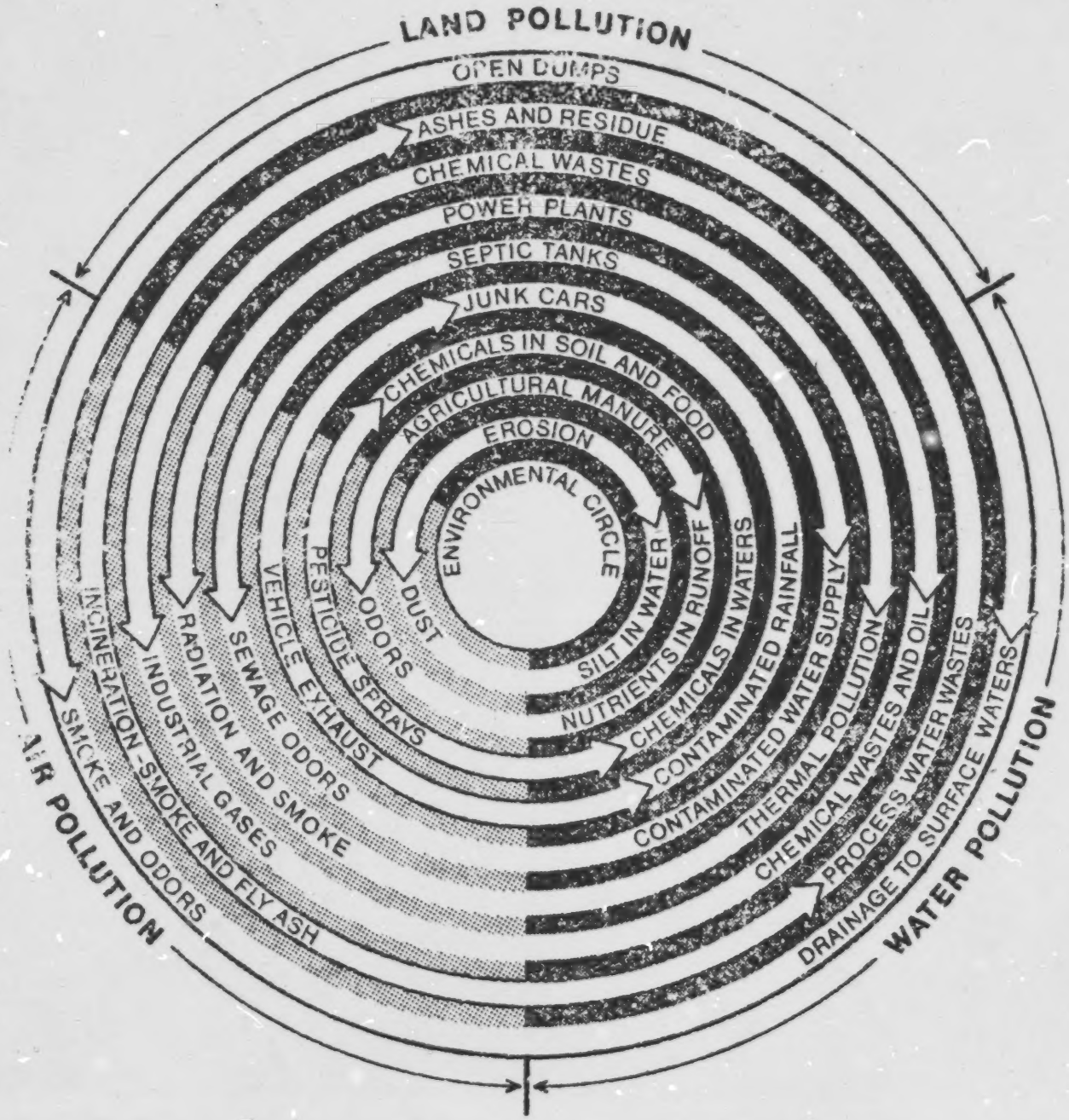
ENVIRONMENTAL CIRCLE

SHOWING MANY KINDS OF POLLUTION AND THE EFFECT ON THE TOTAL ENVIRONMENT



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D E C L A R A T I O N O F D E P E N D E N C E

I am a part of Nature
I am bound together with all living things
in air, in land, in water.
My life depends upon Nature - -
Upon its balance, upon its resources,
and upon the continuity of both.
To destroy them is to destroy myself.
As a member of the human race
I am responsible for its survival.
I AM PART OF NATURE.
I WILL NOT DESTROY IT.

- - - Henry Gibson

00013

ACTIVITY 1: Population

Purpose: To help the student understand the consequences of unchecked population growth and its many effects on our quality of life.

Behavioral Objectives:

The student will analyze charts and diagrams that depict the increasing population as measured by teacher observation of group participation.

The student will read and analyze books and pamphlets concerning the population problems as measured by teacher observation of small group interaction and reports made to the class.

Materials Needed:

Films:
Population and the American Youth
Environment

Pamphlets:
More: The Interforces Between Population, Economic, Crowth and the Environment
Environment
Synopsis, Viewpoints of Social Issues

Books:
Future Shock
People! An Introduction to the Study of Population
The Population Bomb
1971, 1972, 1973 EQ Index
Overpopulation: How Many Are Too Many?
The World Population Dilemma
The Environmental Handbook
Eco-fiction
The Greening of America

Maps:
Wall map of Pulaski County showing the growth of Little Rock,
8 x 11 maps of City of Little Rock

Vocabulary:

1. Arithmetic progression: a series of numbers that increase by a constant number

2. Birth rate: the number of births per thousand people per year in the population

3. Death rate: the number of deaths per thousand people per year

4. Demography: the science of vital and social statistics as of the birth, death, diseases, marriages, etc of the population

5. Doubling time: the number of years it takes for a population to double

6. Geometric progression: a series of numbers that increase by multiplying the previous number by a number

7. Green Revolution: a collection of changes that has produced an agricultural transformation resulting in increased food production

8. Net migration: immigration - emigration

9. Optimum population: the number of people the global environment can support comfortably

10. Population shift: movement of people from one area to another, for example, rural area to urban area

11. Proliferation: to grow by rapid production of new parts, cells, buds or offspring

12. ZPG-Zero Population Growth: an international organization dedicated to educate and influence governments to supply services to people who will control and stabilize their own population.

Procedure: Assign each population sub-group one of the sets of questions to research and discuss. They will present their findings to the class during the third week of the unit.

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United States Environmental Problems: Population

Research and Discussion Questions

Sub-Group One

1. Identify Thomas Malthus.

2. Discuss the Malthus' thesis:
   1. Food is necessary for existance of man.
   2. Passion between the sexes is necessary.
   3. The power of population to increase is infinitely greater than the power to produce subsistance.
   4. Population increases geometrically 1, 2, 4 8, etc. Subsistence increase arthmetically 1, 2,3, 4, 5, etc.

3. What is meant by geometric progression?
   Consider: A student wishing to work in a drugstore for one month talks the owner into giving him 1 penny for the first day's work, 2 pennies for the second day's work, 4 pennies for the third day's work, and so on, doubling the amount each day. The owner believing he has encountered a real dummy agrees to hire the student for one month. Determine his wage on the 15th and 30th working day. What would a second students wage be on the 15th and 30th day if he received a penny the first day and a penny raise each day?

4. Is Malthus' estimate of population growth reasonable?

5. What recent technological development, which Malthus could not have forseen has occurred to alter the expected increase in food production?

6. What about the Green Revolution?

7. Are our environmental problems due to too many people for available natural resources or are they more related to U. S. Economic growth?

8. What do scientist, such as Dr. Paul Ehrlich author of The Population Bomb think of the Malthusian doctrine today?

9. What is meant by Zero Population Growth?

10. Has the U. S. reached ZPG? If so how valid are the statistics?

11. Is the United States made up of a young population or an older population?

12. What is the implication for the future?

13. What is the difference between family planning and birth control?

14. What are some of the pros and cons of family planning and birth control?

15. What action has Congress taken in regard to family planning?

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16. What is your reaction to this statement?

"The average American shares a greater burden of guilt than any other segment of the world's population for the over-populated world. The three and four child family has been in vogue in the U.S. for the past few decades. The attitude has been, 'if I can afford it, why not?'"

17. Hypothetical situation: This situation ignores any movement of people into and out of Lower Slobbovia.

Suppose that there were 80 births in Lower Slobbovia during 1970, and that the population of Lower Slobbovia was 2,000 on July 1, 1970. What would the birth rate be?
Similarly if there were 40 deaths in Lower Slobbovia during 1970, the death rate would be how many?
Subtracting the death rate from the birth rate gives us the rate of natural increase of lower Slobbovia for the year 1970.
What was the natural increase?
Dividing this natural increase rate by ten expresses the increase as a percent (the increase per hundred per year).
What was the percent of increase?

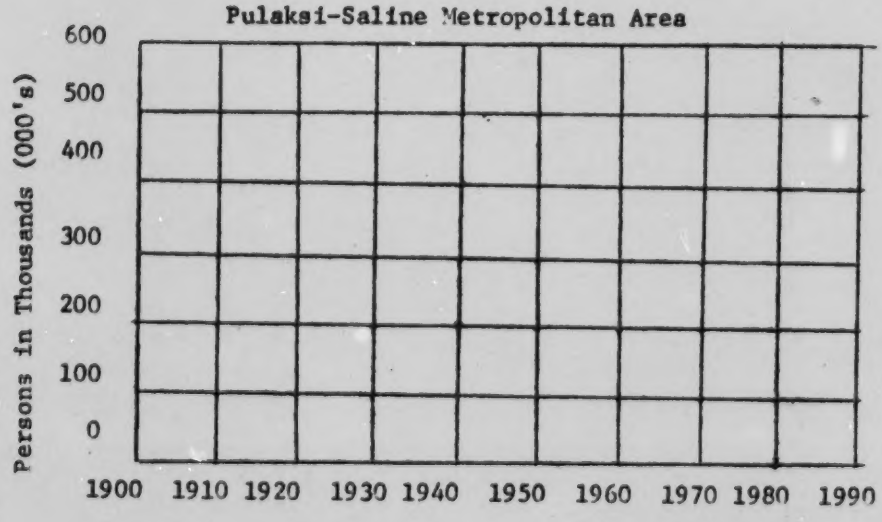
18. Population in the Pulaski-Saline Metropolitan Area:

From a 1900 population of 76,301, the Metropolitan Area's population increased to 271,936 by 1960. Population estimates prepared by the Bureau of Business and Economic Research of the University of Arkansas indicate that both Arkansas and the Metropolitan Area have experienced population growth since 1960.
In January 1968, the Metropolitan Area Planning Commission estimated a Metropolitan Area population of 342,800 persons. The area is continuing to account for an increasingly greater proportion of the state's population.

These past population trends substantiate optimistic forecasts for future growth in the Metropolitan Area. In-migration and industrialization have tended to accelerate the rate of growth. Based on these trends the Metropolitan Area's population is projected to approach 549,000 by 1990.

POPULATION GROWTH 1900-1990

Pulaksi-Saline Metropolitan Area



Metropolitan Projections

What implications does this graph have for you and your life here in Little Rock as to your need for employment, home, church, recreational facilities, and public services?

United States Environmental Problems: Population

Research and Discussion Questions

Sub-Group Two

Questions for Research, Thought and Discussion

1. Read "The Subliminal Man" from Eco-fiction pp 157-178. While you are reading, list at least five incidents from the story that can be related to something that you have seen or done. Be ready to share some of these experiences with the class.

2. Read and discuss pages 70-73, 166-167, and 263-284 in Future Shock. Now compare this assignment with your reading of "The Subliminal Man". Which reading had the greater impact? What methods did each author use to get his point across? What advantages and disadvantages does fiction have in comparison to non-fiction when approaching a subject like advertising? Consider the pros and cons of the consumer having no choice or of having "overchoice". Which do you think is better and why?

3. If time allows read the following and consider the questions:
   Moment in the Sun, pp. 215-229
   "The Law" from Eco-fiction, pp. 54
   "The Mary Celeste Move" from Eco-fiction, pp. 145
   "Tomorrow and Tomorrow and Tomorrow" from Eco-fiction, pp. 119.

   Are we free individuals or are we controlled by our environment? Will this become more or less so in the future? If any of you have lived in a small town or in a rural area, what are some of the differences between that life and life in Little Rock? Do people ever get in your way here? Is there anything in your daily life that takes from your personal freedom and dignity? (bells, lines, etc.) If time allows write down the main idea and at least three supporting statements from Moment in the Sun.

4. Read chapters 6 and 15 from Future Shock. Find out how many numbers (telephone number, social security number, credit card numbers, etc.) your father, mother, and you have now. Are numbers all good or all bad? Will there probably be more or fewer in the future? List ten things in Chapter 6 which you have done or felt. Which are the most harmful changes in human interrelationship which Toffler sees? Which are an affront to human dignity? Can we do anything to stop such changes?

   NOTE: As you read from these books keep in mind that certain themes are evident:
   1. Moment in the Sun - shows what America is like now.
   2. Future Shock - shows what America may be like in the future
   3. The Greening of America - shows how the youth of today may be changing and improving the quality of life in America.

5. Read Chapters 1 and 2 of Population Bomb. What problem does it present? What is being done about this problem?

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United States Environmental Problems: Population

Research and Discussion Questions

Sub-Group Three

Questions for Research, Thought and Discussion

Source readings 6, 7, and 8, pp. 655-661 in Rise of the American Nation. Then answer the following questions as well as the ones in your text. As you read these articles, review and support your impressions by using the other books and pamphlets in the classroom.

Source Reading #6:

1. Can man domesticate himself?
2. What were the crucial issues presented in this essay?
3. It has been said that today having more than two children constitutes an act of social aggression. What do you think of this statement?

Source Reading #7:

1. Soutce Reading #7 introduces the idea of short-term benefits and long-run problems.
2. Can this concept be applied to other topics studied in this group of Source Readings?
3. Can such ideals as the good life and the good society be pursued with out considering the implications of population pressure?
4. Use the figures and dates given in the second paragraph of the Source Reading and the chart provided to make your own graph showing the increased United States population since 1940.
5. What are the severe national problems Mr. Hauser says are a direct result of the United States' population explosion?
6. Consider the Alaskan oil pipeline, underground nuclear testing, and the building of dams as possible solutions to the increasing population needs in the creation of environmental problems.

Source Reading #8:

1. What attempts have been made to meet the teen-agers problems in the 1970's?
2. Do you agree that "society has not even begun to recognize its responsibility?"
3. What suggestions do you have for solving these problems?
4. What is meant by "marry in haste and repent in leisure"?
5. Why has this quote changed to "marry in haste and repent faster"?

In your text book, Rise of the American Nation, the population growth maps of the U.S., pages 782-783, give a graphic summary of the Westward Movement. In 1790 all but a few hardy pioneers lived in the 13 original states along the Atlantic seaboard. Then, as the nation grew, people poured westward. In 1970 the most heavily populated state was California Equally striking has been the shift of population from rural to urban areas. In 1790 more than 90% of Americans lived in rural areas by 1970 only about one-third.

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Refer to the article on "Rural Population Declining" on p. 13 and the map in figure 4 in the pamphlet More. Do these help to explain the maps in your text? Explain the reasons for the heavily populated areas and the vary sparsely populated areas. If the population of the U.S. keeps increasing how will the increase affect both areas? Below is a copy of an article taken from Time, July 2, 1973. Read it and decide how this innovation would affect sparsely populated areas?

THE GARBAGE GOD

Set in the arid plains of western Texas, the small city Odessa (pop. 79,000) was built for one reason: exploitation of the immense oil deposits that lie around it. But today's riches disguise tomorrow's problems. The oil reserves will run out in 15 to 20 years--and then what? The town has no other industry, and the surrounding land is too poor to support large-scale cattle ranching, much less farming.

Yet Odessa need not become a ghost town. At least that is what Dr. Geoffrey Stanford says. A blithe, British-born M.D. who conducts research and teaches at the University of Texas School of Public Health, he insists that Odessa can build a new prosperity on an unlikely foundation--its own wastes.

The key to Stanford's plan is the cellulose in wastepaper and grass clippings. Although cellulose is indigestible for man, it is the basic diet of microorganisms that can trigger a natural sequence of soil enrichment. Stanford proposes to plow cellulose-containing material in garbage into the desert soil. Next, he would fertilize it with "sludge" a purified end product of sewage treatment that looks like gruel, smells like tar and is loaded with nutrients. Using a little sewage water for irrigation, Stanford says, will then turn the desert into a vast garden. His theory makes emminent sense to scientists--and to Odessans, who believe him even when he rhapsodizes about Sunday strolls through the city's future "forests".

The Odessa project will start next fall. Every day, 250 tons of garbage, 20 cu. yds. of sludge, and up to 5000,000 gal. of sewage will be sent to a 640-acre plot that one rancher has donated to the experiment. Other landowners are anxious to follow suit. Indeed, says Jack Dillard, director of Odessa's utilities department, "we may have some fights over people wanting to have city garbage dumped on their land--a new kind of range war."

The problem of processing the garbage before it is plowed under will be handled by Alton Newell, a millionaire manufacturer of auto-shredding machines in San Antonio. Seeking to diversify his company, he is building a special highly automated garbage-handling machine for Odessa. It will sort out the wastes and crush them into small pellets. Old paper and other leftovers will go to Dr. Stanford's project. Newell will sell the metal wastes to recyclers until he recoups the $800.000 construction cost of the machine, which he will then turn over to Odessa for $1.

Meanwhile, the city will save about $60,000 a year by feeding garbage to the machine instead of trucking it to man-made holes in the desert.

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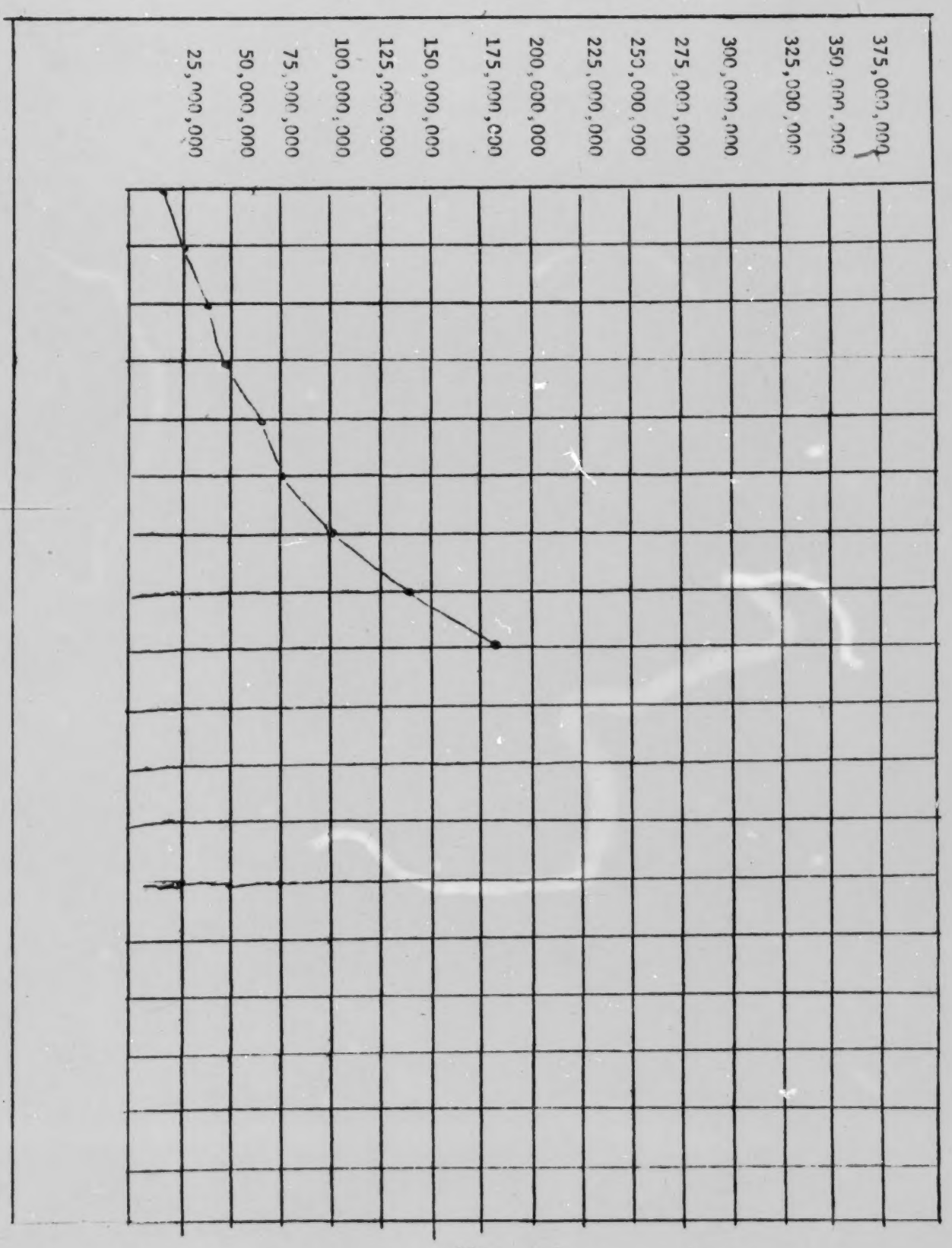
By 1979, Dr. Sanford believes, Odessa should be well on its way to becoming an agricultural center. To be sure, some important points must first be resolved. He has not yet decided, for example, exactly which crops should be planted. He must also confront a Texas law banning the sale of food grown in human wastes, even though the sludge contains neither pathogens nor "any element of sham or sin". To prove the point, he will reserve 16 acres for scientific tests of all trace elements in various crops.

Odessans call Dr. Sanford "The Cod of Garbage." He does not quarrel with the title. Sipping wine in his Houston home, he talks of using wastes to transform wastelands everywhere. The day will come, he confidently predicts, when London will fly its garbage to Saudi Arabia in trade for oil and gas.

Do the maps on pp 782-783 help to back up the statement: "The most common form of overpopulation involves not too many people for available space, space, but too many people for available resources"?

00021

UNITED STATES POPULATION



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ACTIVITY 2: Technology

Purpose: To help students understand how the unplanned shift from simple tools to more sophisticated machinery (technology) to meet man's insatiable desite for an easier and better life now threaten our existence and, unless preventive measured are implemented, could lead to total destruction of the environment which supports us.

Behavioral Objectives:

Students will recognize the problems created by technological developments as well as those problems solved by it as measured by teacher made tests, special oral reports, filmstrips, special reading and an Urban Encounter.

Students will realize the need for control of technological growth and development in order to save our environment as measured by their willingness to become involved in local and national programs presently dealing with these problems.

Materials Needed:

Maps of Little Rock Area showing the city limits in 1893, 1930, 1946, 1972 and the new boundaries, if 1972 annexation becomes official.

Pamphlets:
More
Questions and Answers
Directory of Arkansas Industries

Books:
The Closing Circle
Silent Spring
Future Shock
Disappearing Wetlands of Eastern Arkansas
Rise of the American Nation, Volume Two

Films
Clean Town, U.S.A.

Articles
"Isaac Asimov's mind travels to 3000AD"
"Magnet of Higher Pay draws Commuters to LR"
"Construction of Resort Community Begun at Round Mountain Near I-40"

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Vocabulary

1. Affluent: having an abundance of goods

2. Automation: machines that operate other machines and regulate themselves

3. Durable goods: goods that are relativley long lasting: their purchase can be delayed

4. GNP - Gross National Product: the total value of all goods and services produced in a country in any one year.

5. Industrial Revolution: change from small scale or domestic production to the factory system; from hand production to machine production

6. Non-durable goods: goods that are consumed in a relatively short period: they must be replaced fairly often

7. Non-renewable resources: resources that once used or misused cannot renew themselves ie. coal, oil

8. Polynucleated: consisting of many centers of development

9. Renewable resources: resources that are normally renewed by nature's own processes: ie. air, water

10. Technology: the totality of the means employed to provide objects necessary for human sustenance and comfort

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United States Environmental Problems Technology

Research and Discussion Questions

Sub-Group One

1. What are some positive effects on society of rapid industrialization?

2. What are some negative effects:

3. In your class reading try to find at least three of each and list them.

4. In your opinion do the negative effects outweight the positive?

5. Ask each student to bring two empty food boxes from home (or use books instead). Pile them in the center of the room. Assign groups of students to represent the population of continents of the world in proportion to the population of those continents. The students representing each continent should come to the resource area (the pile) and remove the fraction of the world's agricultural production (food boxes) used by their continent.

Continent	% Population	If there are 25 students	% of worlds (23) agricultural production	# of boxes out of 50
North America (US -Canada)	6.5%	2	21%	10
Europe - USSR	19%	5	32%	16
Australia-Oceania	1%	-	3%	2
South America	8%	2	8%	4
Africa	9.5%	2	4%	2
Asia	56%	14	32%	16
Antartica	0%	0	0%	0

Allow discussion of the demonstration to show that the United States and Canada use a large fraction of the world's agricultural resources. Why? Does it have anything to do with their high standard of living?

Don't be afraid to be dramatic about the difference between North America and Asia: two "American" students possess 10 boxes and 14 "Asian" students hold 16 boxes. It is a very valid comparison.

6. Using the charts "Industrial Development of the U.S.", pp. 788-789, in Rise of the American Nation, list those factors that gave increasing momentum to the Industrial Revolution.

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7. Why was so little thought given by U.S. citizens, during the period of great industrial development, to industry's effect upon the environment? Is more thought being given to technology and the ehvironment today? Is so, cite examples.

8. One man working for an hour in 1850 had few machines to aid him and he produced little. One man working for an hour today can produce 10½ times the 1850 level. In 1850, machines did about 35% of the work done in industry and on farms. Manpower did 13% of the work and animals did 52%. Today, man and animals do less than 2% of the cwrk in industry and on farms. Machines perform more than 98% of all work. The 1850 side of Graph A is filled in for you. Fill in the 'today' side using the figures in table 4 on Page 789 of Rise of the American Nation.

9. Inquiry: How Do Man's Demands Lead to Greater Production?

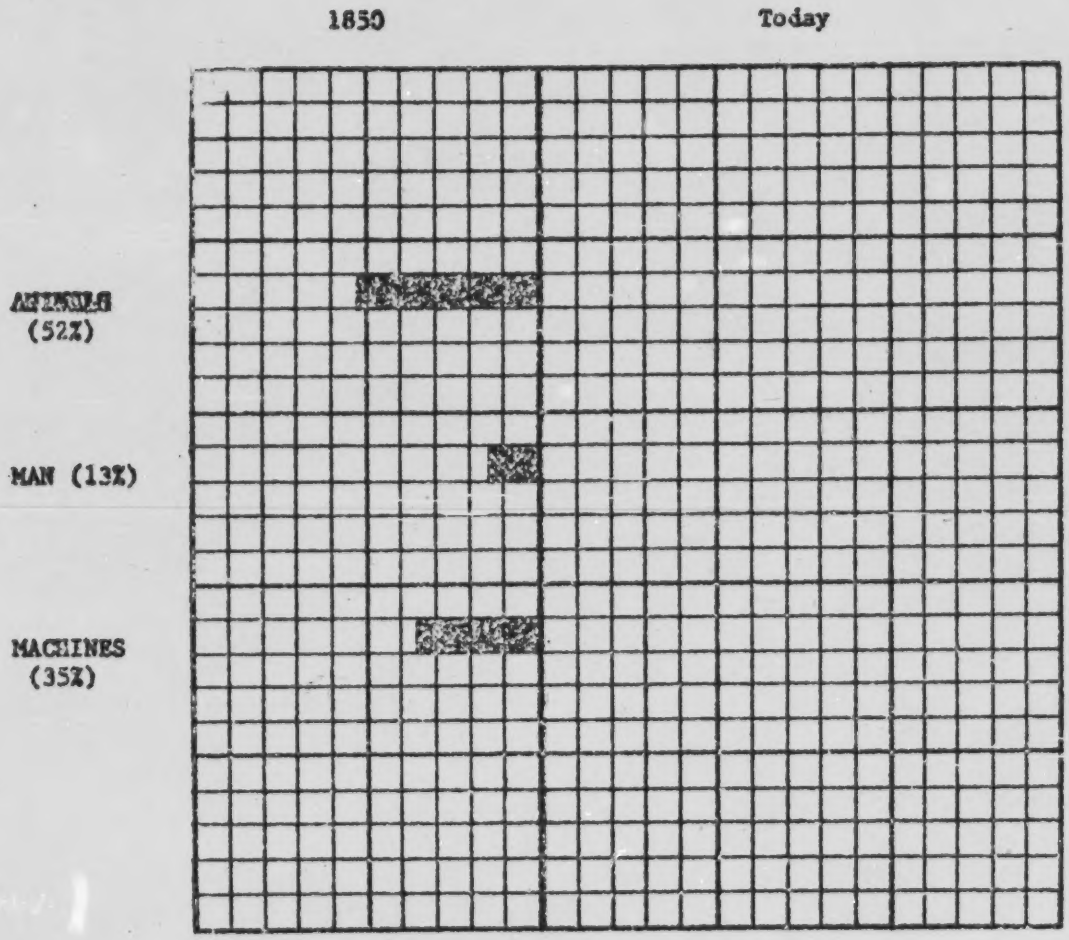
   In 1929 consumers bought 23% more clothing, food and other nondurable goods than they had bought six years earlier, and 33% more durable goods, such as automobiles and furniture. Today these percentages would be much higher. Define "durable goods" and "non-durable goods".

   List the following articles under either durable or non-durable: a pencil, a piano, a television set, a package of cigaretts, a steak, a stereo phonograph, a paper cup, an overcoat, a tractor, a comic book, a washing machine, a desk, a roll of adhesive tape, a bathroom sink.

   Explain how all or portions of these items could cause environmental problems in producing, packaging, using and/or discarding.
   List five kinds of durable goods you use in one day.
   List five kinds of nondurable goods used in one day.
   During your lifetime, which do you think has increased more, the production of durable or nondurable goods?

10. Gross National Product (GNP) is the total dollar value of all goods and services produced during a given period. Economists calculate GNP by adding together these variables: C = consumer expenditures (money spent on food clothing, etc.); I = domestic investment (money spent on machines, factories, tools, etc.); and G = government expenditures (money spent by federal, state, and local governments for goods and services). Thus the formula for GNP is: GNP = C + I + G
    A study of our GNP, reaching almost the trillion mark, would demonstrate the ability of man to alter his environment to satisfy human wants. It will also show you how technology has helped to solve the economic problems of scarcity and growth. What about these new challenges facing technology: progress, population and pollution? How can production methods be changed to prevent pollution? How can consumption be changed to help control pollution? How can the re-use of wastes increase productivity?
    A rise or decline in any of these variables (GNP = C + I + G) results in a corresponding rise or decline in GNP.
    Using Graph B tell how much the United States GNP has increased between 1945-1970? What caused this enormous increase? Which of the three variables is responsible? Does this graph reveal anything about natural resources in the U.S.?

GRAPH A: SHIFT IN POWER SOURCES



The 1850 side of the graph has been filled in for you. Fill in the today side using the figures referred to in Question 8.

Each square represents 10%.

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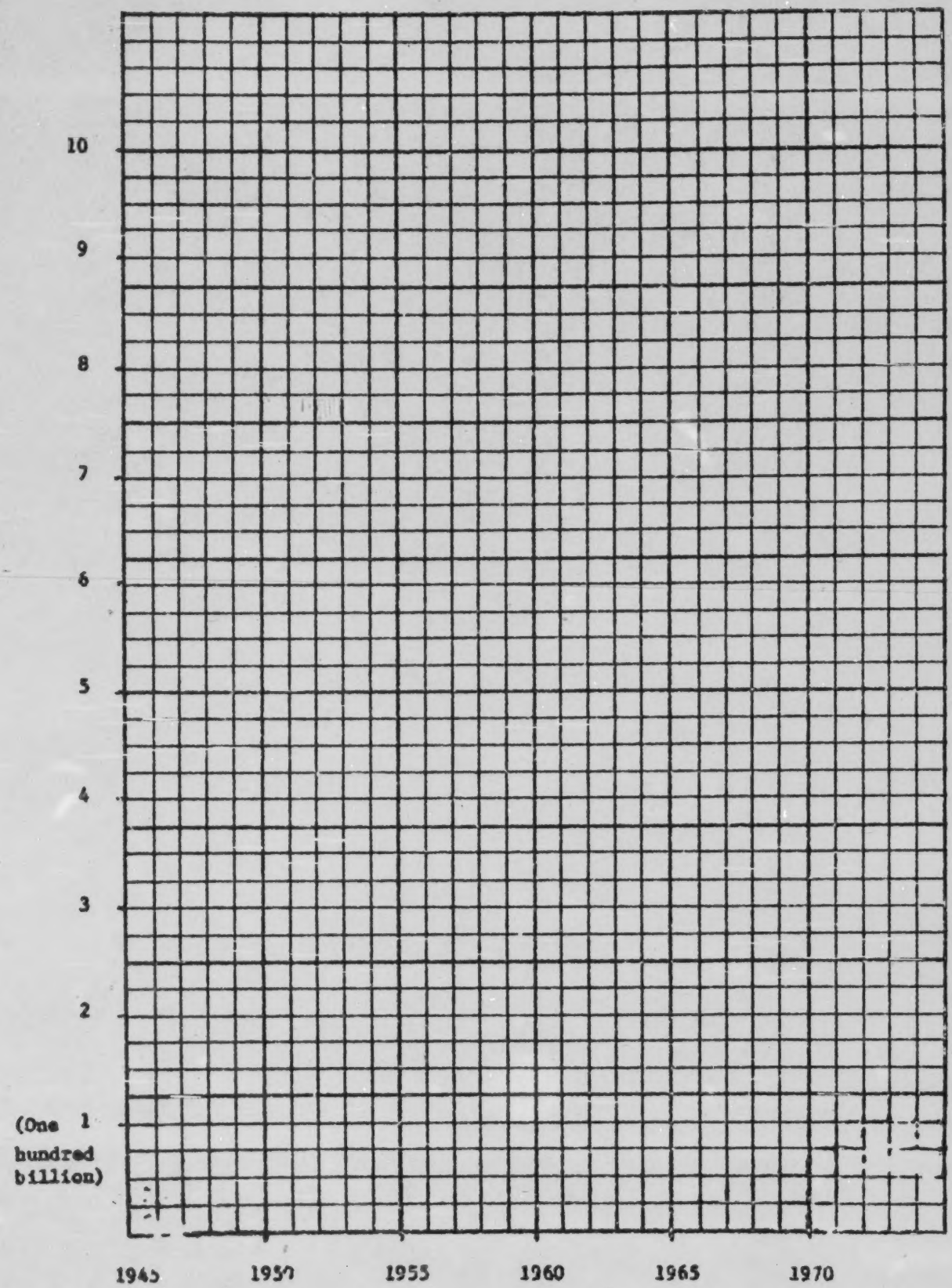
GRAPH B: GROSS NATIONAL PRODUCT (GNP)



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11. Inquiry: Something New

The following technological developments have influenced the growth of big business. Select one invention and answer the following questions. Remember a study of industrialization includes not only the growth and development of big business, but it takes into consideration the effect of hugh industries on the economy, society, and government.

1821 - Reaper (McCormick)
1834 - Electric Motor
1843 - Typewriter
1844 - Telegraph
1846 - Sewing Machine
1848 - Rotary printing press
1851 - Bessemer process of steel making
1852 - passenger elevator
1860 - first petroleum refining

Did this invention change production methods? If so, how?
How would our lives be different today if this invention had not been achieved?

United States Environmental Problems: Technology

Research and Discussion Questions

Sub-Group Two

1. Read Source Readings 3, 4, and 5, pp. 649-655 in Rise of the American Nation.

2. Source Reading 3 warns of the need for putting aside outdated thinking, institutions, and methods so that man can adapt to his new world. Mr. Szent-Gyorgyi calls for new ideas in response to our changing technology. As a group decide on a problem caused by technological growth in weapons development or other technologically changing areas and suggest a totally new approach to this problem. Be sure and include the implementation of your solutions.

3. Source Reading 4 describes the progress scientists have made in developing a machine with a mind of its own. If change presents us with more perplexing problems, as outlined in Source Reading 3 and 4, should we try to slow down technological development? Are there other developments in our world which make accelerated technological growth a necessity? Do you think scientific and technological growth is based upon efforts to build the good life and good society as you define these terms? Do you think your answer would be the same if you were an industrialist? a conservationist? What could be done to make scientific and techological development proceed in the direction of the good life and good society? The United States was born out of change, and its history is one of continuous technological growth. What have we learned from our past experience that can be applied to the rapid change of today?

4. Source Reading 5 points out the advantages and disadvantages of the continuing scientific revolution. Do you think all technical progress is counteracted by negative effects? Does technology raise more problems than it solves? Is it possible to separate the destructive effects from the more desirable effects? Does every technique imply unforseeable effects?

5. Read the article "Isaac Asimov's mind travels to 3000 AD" and decide whether in the next 1000 years man will experience famine, epidemics and violence or a hugh world park where men, plants, and animals flourish in a balanced ecosystem.

6. The Cost of Technology

I am a Fisherman
AIKICHI KUBOYAMA
By Name. On the
First of March
1954 our Fishing
Boat the Lucky
Dragon Wandered
Under an Atomic Cloud
Eighty Miles from
Bilini. I an my Friends
Were Burned
We do not know
What Happened to Us
On September Twenty
Third of that Year
I died of Atomic Burn

Between 1945 and 1970 the nuclear powers announced more than 360 above-ground nuclear or thermonuclear bomb tests. These powerful explosions sprayed radioactive particles into the stratosphere where they remain indefinitely, blown by high altitude winds around the globe. Eventually some particles fall to earth in fog, rain, or snow. Thus radioactive fallout may descend years after an explosion in places remote from the bomb site. Radiation can cause mutations in living organisms. Worldwide atmospheric testing of nuclear bombs has increased human exposure to radiation, though how fallout materials may affect future generations is a matter of speculation.

How do atomic explosions in the atmosphere affect life around the world?

7. Is environmental neglect a worldwide problem? Suppose the U. S. could eliminate pollution, control population growth, and regulate technological growth, how would the failure of the other nations to do the same effect us?

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United States Environmental Problems: Technology

Research and Discussion Questions

Sub-Group Three

1. Use the Maps of Pulaski-Saline Metropolitan Area to compare the growth of the area in 1893 with today, noting the increase in land area, industrial areas, and residential areas. Of what benefit have these changes been to the citizens of the Metropolitan Area? What are some harmful effects on the environment?

2. Using the Directory of Arkansas Industries, 1973 fill in the following information. (Note the key to employment numbers are at the bottom of the page.) Use Pulaski-Saline listings only.

   Number of Industries that employ

   1 - 49 persons _____

   50 - 99 persons _____

   100 - 199 persons _____

   200 - 299 persons _____

   300 - 499 persons _____

   500 - 999 persons _____

   1,000 - 2,499 persons _____

   2,500 - and over _____

   Number of Industries that are exporters _____

   Number of New Industries that have been located in the Metropolitan area in your lifetime _____.

   What conclusions can you draw about industry in the Metropolitan area?

3. Read the article from the Sunday, June 25, 1973 Arkansas Gazette and relate this to the statistics you've just compiled. How have the industries created a need for highways?

   What is this doing to the Little Rock environment?

4. Inquiry: Industrial Progress

   Over the years society changes its values and the priorities of these values. During America's Industrial Age, the growth of industry was a sign of progress. A part of this progress was the exploitation of natural resources to further the development of business interests. Do we still believe the exploitations of natural resources is a sign of progress? Explain. What can government do to control industrial exploitation?

What do you think should be the role of industry and big business in society? Should it be only an economic force? or should it become a social institution concerned with the good of society?

5. Inquiry: City Planning

Imagine you are planning a city. You must decide what kind of environment you want to create. Name three criteria (standards) you want fulfilled in the following areas. Be sure and consider transportation, waste disposal, and power generation.

Industrial	Residential
Recreational	Utilities
Educational	Commercial

Some possible hints in developing your city might be gained from reading the Arkansas Gazette Article "Construction of Resort Community Begun at Round Mountain Near I-40" and Source Reading 13, pp. 671-675, Rise of the American Nation.
Consider such questions of daily living as:
How far to stores, church, school, theaters?
How will air pollution and sewage removal be handled?
How much noise will be generated?
How will the community be drained after a heavy rainfall?
Where will cars be parked?
Where can people swim and go to "just hang around"?
What implication does urbanization have for our present political system?
What changes will be necessary for a predominantly urban population?
Will freedom, as we know it today, still exist by the year 2000 if the predictions of population increase come true?
You may want to investigate recent new communities: ie. Reston, Virginia; Columbia, Maryland; Disneyworld in Lake Buena Vista, Florida; and Park Forest South, Illinois. Investigate their innovation, successes, and short comings.

ACTIVITY 3 Pollution

Purpose: To help the student in the refinement of his preception and the perfection of his understanding of the environment.

Behavioral Objectives:

Students will be able to examine our source and use of water and raise questions on the conservation of this natural resource as measured by group participation, research, and reports to the class.

Students will analyze the affect of urbanization, consumption by the individual, and weather conditions on the air currents as measured by group participation, research, and reports to the class.

Students will be able to calculate his own contribution to the solid waste problems and analyze the impact that our affluence, agricultural habits, and industrial growth have in increasing the solid waste problem as measured by teachers observation of group work and reports.

Materials Needed:

Books:

Our Troubled Waters
The World's Exhaust
Mist of Death
How Many Are Too Many?
Silent Spring
The Environmental Handbook
Since Silent Spring
A Guide to the Study of Environmental Pollution
The Closing Circle
Directory of Arkansas Industries 1973
Rise of the American Nation

Pamphlets:

This is Little Rock
Little Rock Municipal Water Works Story
Your World, My World
Solid Waste - It Won't Go Away
Arkansas Solid Waste Management Report
The American Federationist
Sanitary Landfill Facts
Recycle

Articles

"Many Injuries Reported From DDT Substitute; Dangers Seen in South" from Arkansas Gazette Sunday July 22, 1973

"Report Says Car's Gas Mileage Can Make $500 Difference", from Arkansas Gazette, Sunday, July 22, 1973

"Baja California Providing Energy Without Pollution", from Arkansas Gazette, June 29, 1973

"Steamed up from heat" from Arkansas Democrat, Tuesday, June 19, 1973

Vocabulary:

1. Air Contaminant: any foreign solid, liquid, or gaseous material in the air

2. Air pollution: the presence in the outdoor atmosphere of one or more air contaminants in quantities, of characteristics and of a duration which are materially injurious or can be reasonably expected to become materially injurious to human, plant or animal life or to property or which unreasonably interferes with enjoyment of life or use of property

3. Commercial refuse: all solid wastes which originate in business operated for profit such as office buildings, stores, markets, theaters, etc.

4. Deforestation: removal of trees from an area leaving the area exposed to all weathering elements

5. Desalinization: the removal of salt from ocean's water

6. Domestic refuse: all solid wastes which normally originate in the residential household or apartment house

7. Hydrology: the study of water and its movement

8. Incineration: the burning of garbage, it reduces the volume of garbage by 80 to 90%. The reduction by weight is usually 75 to 80%

9. Industrial refuse: all solid wastes which result from industrial processes and manufacturing operations such as factories, processing plants, repair and cleaning establishments, refineries and rendering plants

10. Open Dump: the consolidation of waste from one or more sources at a central disposal site which has little or no management

11. Particulate matter: any material, other than uncombined water, which exists as a liquid or solid at standard conditions

12. Persistent pesticides: this means they remain in the environment, with the same dangerous characteristics, for many years

13. Pesticides: are substances used to kill pests. The pests may be weeds, insects, rats & mice, algae, worms, & other destructive forms of life

14. Primary Sewage Treatment: screening process to remove large particles and a settling process in which particles settle downward as sludge or rise upward to the surface as scum

15. Sanitary landfill: a method of disposing of refuse on land without creating nuisances or hazards to public health or safety. The refuse is confined to the smallest practical area, reduced to the smallest practical volume, and covered with a layer of earth at the conclusion of each day's operation.

16. Secondary Sewage Treatment: utilizes the introduction of bacteria to the water in an accelerated environment to purify the water

17. Solid Waste: the disposed goods man no longer wishes to use

18. Suspended particulate matter: particulate matter of such characteristics which normally require collection by filtration and not by gravitational settling

19. Temperature Inversion: when a mass of cold air is trapped beneath a layer of warm air and thus capturing the colder air

20. Tertiary Sewage Treatment: the effluent is sent to a tank called a filter gallery. The base of the tank is composed of a multimedia bed, usually anthracite coal and sand. The effluent drains through this bed where microscopic solids are filtered out and aerobic bacteria get a final crack at everything

21. Thermal pollution: a term used to describe the harmful impact of heated water on the water source and its environment

22. Water pollution: the introduction into a body of water of substances of such character and of such quantity that its natural quality is so altered as to impair its usefulness or render it offensive to the senses of sight, taste, or smell

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United States Environmental Problems: Water Pollution

Research and Discussion Questions

Sub-Group One

1. From the diagram below determine what percentage of the people in the U.S. drink water below federal standards? What causes water pollution? What effects may the quality of the water have on our people? How can this be corrected?

QUALITY OF U.S. DRINKING WATER

105 million people — drink water that meets Federal Standards

95 million people — drink water below Federal Standards or of unknown quality

2. Calculation of school's water consumption:

Consult with the local water authorities and secure information on the typical volume of water supplied to the school during a day. Where does this water come from in reaching the sinks, taps, drinking fountains and toilets? What does this source of water have to do with the water cycle? (rain, runoff, drainage, and other processes) What effects would deforestation have on the supply of water in your school? What is the per capita use of water by the school population? (in 1969 George Borgstrom quoted in chapters 6 and 7 of Too Many that the average individuals consumption was 160 gallons in the U.S. as compared to 60 gallons in Western Europe) Would a little consideration from you help to cut down on your usage? What role does the school play in the cycling of water? Compare the school's physical plants, the blacktopped parking lots, the streets and roads leading to the school, the warehouses, factories, and offices to the athletic field and lawn?

3. Is water an expendable natural resource?

4. What does our sewage water have to do the other communities downstream? Are we responsible for the water that goes downstream? Do communities upstream pollute our water source? If so, what actions, if any are being taken to alleviate this?

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5. Municipal sewage accounts for 25% of the total water pollution. According to the National Wildlife Federation's 1970 EQ Index only 10 cities in the U. S. use the most effective kind of sewage treatment, called "tertiary" treatment--and they have a total population of only 325,000. On the other hand, 1,416 cities with 9.5 million people dump raw, untreated sewage into U.S. waterways. What are the three types of sewage treatment? What type does Little Rock have? How many gallons per day are treated? Remember earlier in the questions you read that the average daily use of water in Little Rock is 32.7 GPD. Is 32 GPD treated? If not what happens to the other? Ninety five percent of the city is served by sanitary sewers. What about the other 5%?

6. Read Source Reading #26, pp. 699-702, Rise of the American Nation. Population growth and technological development have built up environmental pollution at an alarming rate as shown in Source Reading 26 which deals with water pollution. What is our water bank as referred to in Mr. Farb's article? What is the problem? Why are the nation's rivers polluted? What are some of the solutions? What is desalination? Is this a feasible alternative? How would the desalination process aid Little Rock? Salt Lake City, Utah? Mr. Farb says that our use of water is expected to triple by the year 2000. In Little Rock now our average daily use is 32.07 GPD. Where will this water come from? What facilities will we have to have to provide quality water for all residents of the area? Is there a possible career here for you?

7. Inquiry: Water Pollution Sources

   According to Directory of Arkansas Industries 1973 industries in Arkansas are increasing. Industry is the leading source of water pollution in the U.S. accounting for some 60%. The chemicals which contribute most to the load are chemicals, metals, paper, textiles, food products and petroleum refining. Do we have any industries in Little Rock that produce the above items? In Arkansas? If so which ones, how many does each company employ and what can you find out about their use of water and its return to the environment.

8. How is electricity generated in this community? Is fossil or nuclear fuel used? What is thermal pollution? It has been suggested that all our power problems would be solved by the use of nuclear power and breeder reactors. What about the safety of the nuclear power plants? What about the disposal of nuclear wastes (which are radioactive)? How does the local electric company propose to deal with the increasing demands for electricity and the tightening laws against pollution?

9. Agriculture is responsible for about 15% of the water pollution, most of it in the form of "runoff" containing silt, pesticides, herbicides, fertilizers, and animal wastes. Are agricultural practices in this area polluting the waterways? What is the response of the farming interests to this problem? What do pesticides have to do with water pollution? Are these chemical controls successful or do they have serious long-range side effects on other plants and animals in the environment? What is DDT? Is it possible for it to travel long distances without losing its toxicity? DDT is often found in plants and in what part of animals?

Does man, who is near the top of most food chains, receive a concentrated dose of DDT? Do you agree with this statement: "Although work is continually being done to develop the perfect pesticide, the problem really lies in our over reliance on poisons as opposed to nonchemical means of controlling pests." What alternatives to chemical pesticides might control insect pests? What is biological pesticides?

10. What has the federal government done to improve the water quality? Are they making laws and implementing them with funds? Or are they just calling attention to the water pollution problems?

11. If all the water used in a day in the U.S. were divided up among the people, each person would use about 575 liters. The use of such large quantities of water is mainly the result of industrial and agricultural demands. And these demands continue to increase. What is the total daily domestic water use in the United States? (assume a U.S. population of 210,000,000.)

12. We have considered our use of water at school and the sources of water pollution.
Item for Thought: Now let's consider some of our other uses. Some of the water in your last drink may once have been in the Nile River. As impossible as it may sound at first it makes sense when we consider the never ending movement of water. The important thing to remember is that water is used over and over again.

13. According to the data in the table below, what trend is evident in water usage?

AVERAGE DAILY WATER USE IN THE UNITED STATES
Type of Use (billion liters per day)

Year	Domestic	Agriculture	Industry & Steam Elec. Utilities	Total Water Use
1900	19	76	57	152
1920	32	212	103	347
1940	50	269	198	517
1960	106	510	605	1,221
1980*	127	673	1,046	1,846

*Estimated

What activity used the most water in 1900? In 1960? What category has increased its demand for water the most? How does the increase in water use relate to the increase in population during this century? The demand for water will certainly continue to increase. Many serious questions will have to be answered by you. Will there be enough water available to supply a growing population? What can be done to conserve our present water supplies? How can we find new ones? Can water be redistributed so that it's available where most of the people live? Can polluted water be made usable again?

14. If population is going to continue to increase just how much water do people use daily. The table below shows the average amount of water used in some everyday activities.

Average Domestic (Home) Water Use in the United States	
Purpose	Amount (liters/person/day)
Flushing toilets	78
Washing & bathing	70
Kitchen Use	11
Drinking Water	10
Laundry	8
General Household cleansing	6
Gardening	6
Washing the car	2

How much water do you estimate that you use daily? Don't "water" down your estimate . . . .

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United States Environmental Problems: Air Pollution

Research and Discussion Questions

Sub-Group Two

1. What is air? What two gases make up 99% of the atmosphere?

2. What does the air have to do with the quality of our environment?

3. Source Reading #27, pp. 702-705, Rise of the American Nation, describes the problem of poisoned air. According to Dr. Leighton what are the principle sources of contamination? What solutions does Dr. Leighton recommend?

4. In December 1970 the Environmental Protection Agency stated "that the growth in the amount and complexity of air pollution brought about by urbanization, industrial development, and the increasing use of motor vehicles, has resulted in mounting dangers to the public health and welfare, including injury and hazards to air and ground transportation". Does the chart on pp. 788-789 Rise of American Nation reinforce or deny this quote? Explain. Do the charts on pp. 798-799 Rise of American Nation have anything to do with the above quote? How do you spend your leisure hours? How do you make your living? Since man in general is now making more money does his consumption increase the amount of pollution in an area? Do your answers to the above questions indicate you are a major pollutor?

5. From the bar graph, what effect does density of population have on lung cancer? Why? From the line graph, what is the percent rise in emphysema deaths from 1950 to 1964? What does this tell you about air pollution.

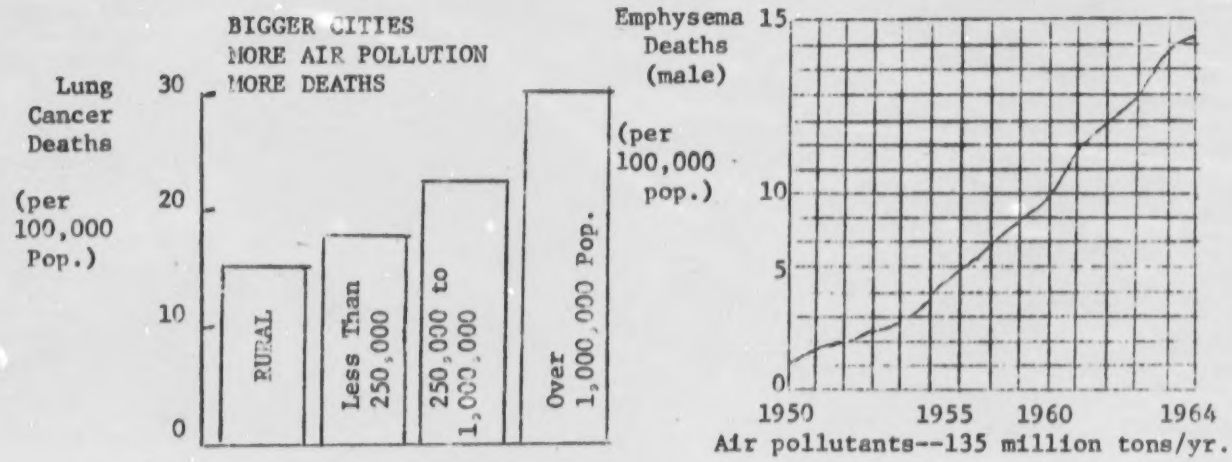

CHART I

Source: A Strategy for a Livable Environment, U.S. Department of Health, Education, and Welfare, Washington, 1967. (I shall refer to this report henceforth as the "Linton report," after the chairman of the Task Force on Environmental Health and Related Problems, Ron M. Linton.)

6. Inquiry Man Causes Air Pollution

How does population contribute in the accumulation and concentration of air pollutants? What can you tell from the chart below? Is there any relationship between an increasing population in an area and the amount of pollution in the atmosphere?

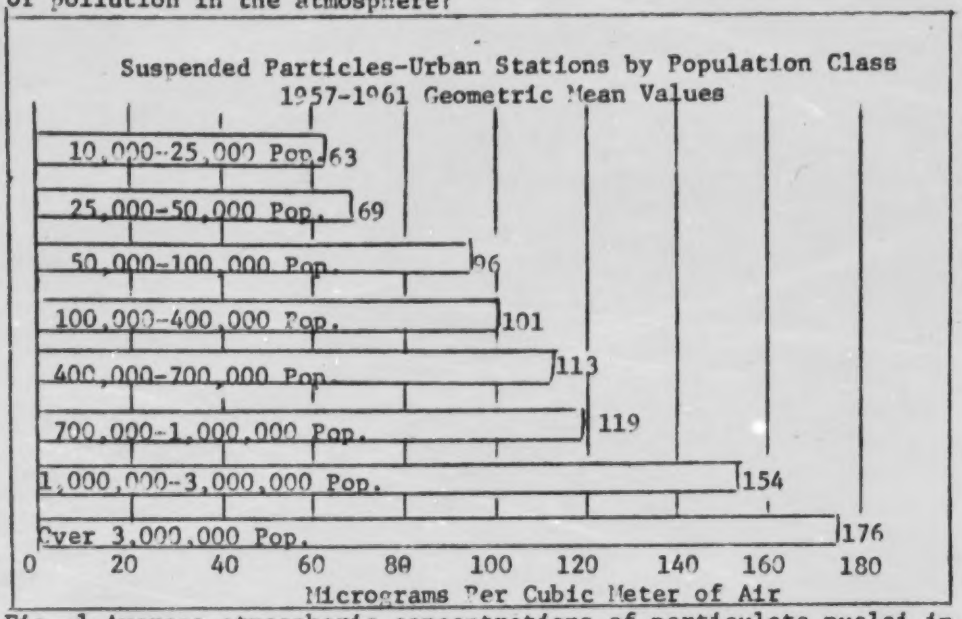

Fig. 1 Average atmospheric concentrations of particulate nuclei in relation to size of settlement by population.

7. According to Directory of Arkansas Industries 1973 has there been an increase in manufacturing companies in Little Rock? In Arkansas? Has there been an increase in the amount of pollution in the air? But industry is not the major cause of air pollution. What is? Do you drive when you could walk.

8. What about the practice of aerial spraying of our crops? Sure we have to have food but Rachel Carson in Silent Spring and Frank Graham in Since Silent Spring warns us of this practice. When were these books first published? Has any progress been made in curtailing, improving or eliminating this practice? Do the charts on page 705 of Rise of the American Nation reinforce some of Miss Carson's warnings?

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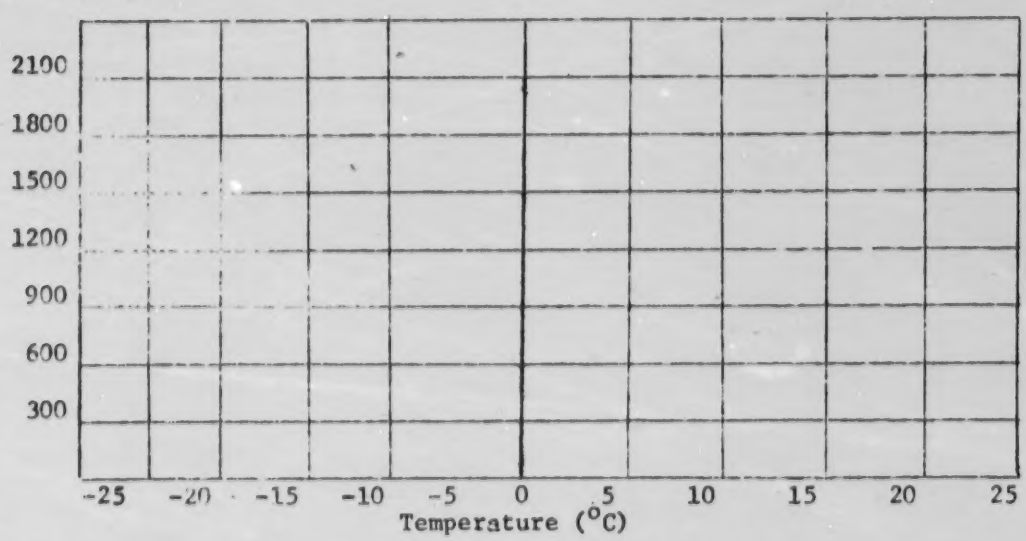
9. Not only do we have the sociological (getting along with your peers) and the economical causes of air pollution, but we have weather conditions that can seriously affect living and nonliving things. What happens when a mass of cold air advances over a city? Warm air is lifted up and over the colder air, isn't it? Why does the advancing colder air lift the warmer air? What is a temperature inversion? Graph the data in the table below that contains temperatures like those you would find in a temperature inversion after a cold front has passed through.

Altitude (meters)	Temperature (°C)	Altitude (meters)	Temperature (°C)
150	15	1200	0
300	13	1350	-2
450	11	1500	-5
600	9	1650	-4
750	7	1800	-2
900	5	1950	1
1050	3	2100	4



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A distinct layering of air occurs. Where is the coldest air? At what altitude do you notice the warmer air layer? How would vertical mixing of the air affect the layering of the air? Suppose no wind is blowing during a temperature inversion. This means the air will be almost motionless. Where are smoke and other air pollutants likely to collect during a temperature inversion?

10. Simulation: You are the Smog Control Director

Would you recommend that the thousands of factory furnaces be shut down whenever a cold front approaches? Why? Would you recommend that all motor vehicle traffic be prohibited whenever a cold front approaches? Why? Would you recommend that artificial breezes be created over the entire city whenever the wind speed dropped to a near zero level? Why? Would you force your city industry to remove solid pollutants from chimney gases before releasing the smoke into the air? Why? Would you recommend that all home furnaces be turned off whenever an air-pollution crisis occurs? Why? How can a warm front lead to a temperature inversion? Would you predict that smog conditions would be worse as a result of a cold front, or of a warm front? Which type of front condition would be most likely to result in a temperature inversion in your area? Why are smog conditions less frequent in farming regions than in industrial centers?

11. We've seen how group pressure, economic desires, agricultural practices and weather conditions contribute to air pollution. Are there ill effects on you the individual? What if you had lung cancer, chronic bronchitis or some respiratory disease? Read and report on "30 Cigarettes a Day" from Moment in the Sun by Robert and Leona Rienow. It would also be interesting to read and report on some of the most dramatic and convincing evidence of the deleterious effects of air pollution on humans. Although the list is not long (Meuse Valley, Belgium, 1930; Donora, Pennsylvania, 1948; London, 1952) the effects of these unplanned exposures were startling and impressive. The Meuse Valley, Donora and London episodes all had much in common, and much knowledge about the likely behavior of an air pollution episode can be gleaned from careful review of the circumstances involved.

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United States Environmental Problems: Solid Waste

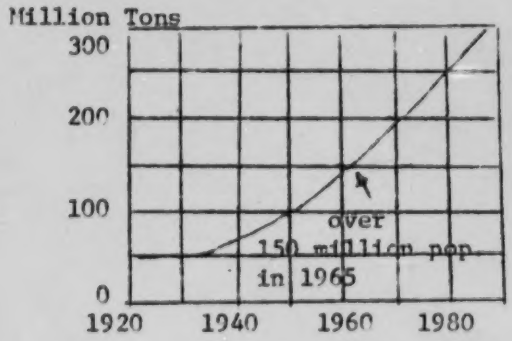
Research and Discussion Questions

Sub-Group III

1. Act 237 which may be cited as the Arkansas Solid Waste Management Act states, "It is the purpose of this Act and it is hereby declared to be the policy of this state to regulate the collection and disposal of solid wastes in a manner that will (a) protect the public health and welfare; (b) prevent water pollution or air pollution; (c) prevent the spread of disease and the creation of nuisances; (d) conserve natural resources; and (e) enhance the beauty and quality of the environment."

   Using the graph below, how much did solid waste production increase from 1920 to 1965? How much is it estimated to increase in the late 1980's? How old will you be by then? How will this affect your life?

SOLID WASTE PRODUCTION IN THE U.S.



2. Inquiry How Much Garbage Do you Produce?

   You will need four large paper bags. Arrange to have your household garbage separated as things are discarded. For example, the members of your family can put all paper materials in Bag No. 1, all metal things in Bag No. 2, all glass and ceramic items in Bag No. 3, and Bag No. 4 gets everything else. Keep a record of all the different kinds of things than go into this last bag. After a few days or week, each bag is weighed before being put out for collection. The total weight of all four bags is then calculated. Record your results in the table below.

Total Amounts of Garbage Discarded
By Students' Families for Different Periods of Time

Table 1

Student No.	No. of People in Household	No. of Days of Collection	Pounds and Ounces				Total Weight
			Paper	Metal	Glass	Other Matls.	
1							
2							
3							
Total Average							

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Now calculate the amount of garbage discarded per person per day. This is a matter of simple arithmetic. For example if a family of two disposes of 16 pounds of garbage in four days, then the average amount of garbage for that household is two pounds per person per day. This is calculated as follows:

$$\frac{16 \text{ Pounds}}{(2 \text{ People})(4 \text{ days})}$$

The result for each student's family should be recorded in the table below. We can now compare the results for different families.

Average Amounts of Garbage Discarded Per Person Per Day

Table 2

Student No.	Paper	Metal	Ounces of Glass	Other Materials	Total Weight
1					
2					
3					
Total Average					

Calculate the average amount of garbage per person per day for all the families involved. Why is it useful to have these averages? The information in Table 2 gives you some idea of the amounts of different things that make up garbage. In order to compare your findings with the results of more detailed scientific studies that have been conducted, you have to calculate the percent of each material. You can do that from the total amounts listed in Table 1. For example, if there are 20 pounds of paper in a total of 40 pounds of garbage, the amount of paper comes out to be 50%.

$$\frac{(20 \text{ pounds of paper})(100)}{(40 \text{ pounds of garbage})}$$

Make those calculations and record the data in Table 3.

Percent Composition of Garbage Calculated from Average Amounts in Table 1

Table 3

Garbage	Average Weight	Percent Composition by Weight
Paper		
Metal		
Glass & Ceramics		
Other Materials		
Total		100

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You can compare this information above the average percent composition of your garbage with the results of detailed scientific studies shown in Table 4.

Average Percent Composition by Weight of
Household Garbage from 21 U. S. Cities

Table 4

Component	Percent By Weight
Food Waste	18.2
Garden Waste	7.9
Paper Products	43.8
Metals	9.1
Glass and Ceramics	9.0
Plastics, rubber, and leather	3.0
Textiles	2.7
Wood	2.5
Rock, Dirt, Ash, etc.	3.7

Table 4 shows that almost half of the typical household garbage consists of paper products. What weight of the following paper items do you discard each week: newspapers, brown bags and wrapping paper, corrugated boxes, plastic coated papers, waxed milk cartons, tissue paper, junk mail, paper food cartons, and magazine paper? Which paper items can you reuse or recycle? What paper products can you do without? What things are discarded by your school? How much is discarded each day in an average classroom? What happens to that paper after it leaves your school? Are there any ways to recycle paper in your community? Could the paper that your school discards be recycled? How can you arrange to have that done? What can your school do with any money that it makes by selling used paper instead of having it taken away as garbage?

So far we have been concerned only with household garbage. Table 5 shows the number of pounds of solid wastes produced per person per day from other sources.

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Average Amount of Garbage Collected,
Pounds per Person per Day

Table 5

Solid Wastes	Urban	[illegible]ral	National
Household	1.26	[illegible].72	1.14
Commercial	0.46	0.11	0.38
Combined	2.63	2.60	2.63
Industrial	0.65	0.37	0.59
Demolition, construction	0.23	0.02	0.18
Street and Alley	0.11	0.03	0.09
Miscellaneous	0.38	0.08	0.31
TOTALS	5.72	3.93	5.32

3. "It seems that the importance of proper collection has been overlooked in the State of Arkansas. Of a total of 151 communities surveyed in the State, only 37 operated a collection system." p. 39 Arkansas Solid Waste Management Report. Read and report on the different types of collection and what is being done.

4. "While most wastes constitute a problem, there are wastes which present special problems in some areas of the State. These wastes are found primarily in the agricultural community of the state and are: rice hulls, canning wastes, dead chickens and rotten eggs, and agricultural chemical containers. p. 75 Arkansas Solid Waste Management Report. Read this and relate how we here in urban Little Rock are affected by these special problems in the State.

5. Inquiry: How Rapidly is the Garbage Problem Increasing?

   It has been said that Americans are producing garbage faster than people. Do you agree? What is meant by this statement?

6. What is the connection between affluence and waste?

7. According to the table on pages 88-89 of Arkansas Solid Waste Management Report, what industries in Arkansas are the largest producers of wastes. What industries come in second? Do you see any connection between this table and table 4?

8. Source Reading #25, pp. 697-699, Rise of the American Nation, describes wanton desecration of the land. Who are the desecraters? Do you share Packard's concern? Is so, what steps do you think should be taken to correct the situation? Whose responsibility is it to take such steps?

9. Simulation.

Assume that the community in which you live is located on the sea coast. As the population increases, your town is faced with the problem of garbage and trash disposal. The city engineers and the townspeople disagree on how to dispose of the garbage. Several different proposals have been made to the city commission. They include the following:

1. Hauling the garbage out to sea and dumping it.
2. Using trash and garbage to fill part of the bay and provide additional building sites.
3. Using trash and garbage to fill low lands around the town and make them suitable for building sites.
4. Compressing the trash and garbage into blocks and then covering them with concrete and using them as building materials.

What position would you take on each of these suggestions and why? What alternative(s) would you suggest?

ACTIVITY 4: Environmental Careers

Purpose: To inform students of possible environmental careers.

Behavioral Objectives:

Students will learn about various environmental careers which they might enter to meet the growing demand for trained personnel to solve the problems of pollution as measured by participation in a Careers Day Conference and viewing a film.

Students will recognize that more education and interest are needed to solve environmental problems as measured by his willingness to become involved in educational programs and choosing to prepare himself for an environmental career.

Materials Needed:

Information Sheet:
Careers in the Environment: Job Descriptions

Catalog:
Southwest Technical Institute 1973-74 & 1974-75

Film:
People Who Fight Pollution and a study guide for each student.

Background Information:

For most of us, it is hard to believe that the earth is being absorbed by its people and their pollution. If we are to survive on this planet we are, of necessity, going to have to reidentify some old careers as many new ones emerge to help solve some of our environmental problems.

Not only are we faced with saving our environment, but much of it has to be restored and improved so that all of us can enjoy a quality environment.

All student recognize that many careers are possible sources of income but environmental careers offer greater challenges and satisfaction because efforts are being put forth to reverse the present course toward environmental destruction.

Procedure:

1. All of your morning American History Classes will meet with the Careers Conference Day guests from 9 till 12. Your afternoon classes will meet with them from 12 30 till 3:30.

2. From a prepared list of speakers each student will decide on four that he wants to hear. This must be done at least one week before Career Conference Day. No changes will be permitted. Each American History teacher is to submit an alphabetical list of his students who have signed up for each speaker. Turn this list in to your department head one week prior to Careers Conference Day so he can prepare a ditto master list for roll purposes and so that you can get your room assignment for the day.

3. Each speaker will have forty minutes for his presentation and questions and answers. The students will attend two presentations before the "break" and two afterwards.

4. Each student is to receive four copies of the Environmental Occupational Analysis Guide in order that he may complete one for each career speaker he hears.

5. The film People Who Fight Pollution and the study guide should be of interest to each student. It should be seen before Careers Conference Day.

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Study Guide: People Who Fight Pollution

Questions for Use Before Viewing Film:

What attitudes do most people have toward their jobs?
Did you find satisfaction in your summer work?
Are you enthusiastic about your part-time work?
Are you committed to your job?

Questions for use After Viewing Film:

What characteristics did the three men have which determine their positive work attitudes?

How do they rate on self-image, determination, enthusiasm, optimism, willingness to work?

What is the relation between self-imagine and fulfillment or success of any job?

Rubbish collecting and factory work are not usually considered high status jobs. Is the pride and dignity the men in the film have toward their work related to status?

How and by whom is job status usually determined?

In what other ways do you think status could be measured?

Does formal education or high pay guarantee happiness on the job?

Considering the current and future job market, is higher education alone realistic insurance for getting a job?

How can other assets such as self-esteem, creativity, initiative be developed and used to find a job and overcome job tedium?

The three men in this film are determined and optimistic about the eventual results of their fight against pollution. Do you share their feelings?

What positive action can you take now to help the nation's problem?

You might consider and investigate other job opportunities available in this field.

In what other fields might you find jobs which make a definite contribution to society?

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Name _____ Date _____

School _____ Teacher _____

Occupational Analysis: Environmental Careers

1. Classification of job
   A. General
   B. Specific Branch
   C. Name of particular job

2. Duties performed (major)
   A.
   B.
   C.
   D.

3. Personality traits, interest, aptitudes, physical requirements for job.
   A. F.
   B. G.
   C. H.
   D. I.
   E. J.

4. Which of the above personal characteristics do I have? Do not have? Check (x) on left side of those characteristics that you possess.

5. Education or training needed for job.
   A. Skills needed:
      1.
      2.
      3.
   B. High School courses needed for job:
      1.
      2.
      3.
   C. College courses required:
      1.
      2.
      3.
   D. Where can the necessary training be obtained?

6. What is the outlook for this occupation?
   A. Jobs available locally:
      1. 3.
      2. 4.
   B. Jobs available in state
      1. 3.
      2. 4.

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7. Will this occupation give me the social status I desire?

8. What fringe benefits are available?
   A. Insurance
   B. Retirement
   C. Safety equipment

9. What way is this job of service to the environment?

Careers in the Environment: Job Descriptions

I. Science and Research

Educational Requirements: A bachelor's degree with a major in one of the life sciences is a basic requirement for entry-level positions. However, students planning a professional career in the life sciences should obtain advanced degrees, preferably PhD.'s in a specific speciality area. A master's degree qualifies a person for entry-level positions in most applied scientific research programs.

1. Air

Inorganic Chemist: The inorganic chemist primarily conducts experiments on substances that are free from carbon--such as metals, ores, gases, and heavy chemicals--to develop and improve such materials for productive purposes.

Meterologist: The meteorologist studies the atmospheric phenomena of the earth. He is interested in and attempts to describe and explain the motions, components, influences, and processes of the atmosphere. This science is comprised of many constitutent parts, some of which are: aerology, climatology, and synoptic, dynamic, and physical meteorology. Some of these specialties are research oriented and some are application oriented. The climatologist is research oriented; he interprets statistical data on the wind, rainfall, sunshine, temperature, and other aspects of the climate of a particular area over an extended period of time in order to predict the future climatic conditions of the area. He develops and uses statistical data and other methods to analyze and interpret climatological data. The major component of the latter group is the synoptic meteorologist or the "weather forecaster." Most of his activities are performed indoors, using highly complex meteorological equipment.

The study of air--its composition and its motion--constitutes the basis for understanding air pollution and its potential correction. A meteorologist can play a major role in the analysis of air pollution problems. He also can contribute to the understanding of the causes of water pollution, airborne movement of pesticides, etc., but to a lesser degree than what he contributes to the general understanding of air pollution.

2. Water

Hydrographer: The hydrographer performs activities primarily related to the study of water resources. He samples, measures, and tests river levels, water flow, silt accumulation, water temperature, and and water control equipment. Based on his studies, he prepares reports with supporting recommendations. The hydrographer works closely with meteorologists in the measurement of rainfall, water runoff, etc. Much of the hydrographer's time is spent outdoors. The hydrographer applies his expertise in the control and utilization of water resources. A hydrographer can apply his efforts to developing flood control measures erosion prevention, irrigation, and other water supply uses. The hydrographer can, therefore, apply his talents in several areas of pollution control and resource conservation.

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Oceanographer: An oceanographer studies the ocean, its contents, and its movements. He plans and conducts extensive tests and surveys. The results of his studies serve many industries, both private and public. His studies often involve the development of maps, charts, tabulations, scientific reports, and papers. He needs and uses many different kinds of specialized equipment to study the ocean. He is often involved in the development and design of such instruments. An oceanographer spends varying amounts of time on ships at sea. These excursions can last from a few days to many months.

Most oceanographers specialize in one of the highly technical fields of this work. Those specialty areas which are primarily concerned with the environment are biological, physcial, and chemical oceanography or marine meteorology. With the expanding demand for a better utilization and preservation of our oceans, it is anticipated that oceanographers concerned with the environmental specialty fields will be in demand during the 1970s.

3. Solid Waste

Economist: The economist is primarily engaged in the study and evaluatic man's activities directed toward satisfying his meterial requirements. He is concerned with the problems of the efficient use of scarce or limited supplies of land, materials, manpower, and natural resources and in meeting the demands of those supplies. An economist develops or uses theories and models by which economic activities can be examined and assessed and by which plans, policies, and programs can be made regarding the intelligent and effective use of land, labor, and capital.

An economist can apply his expertise in virtually all of the environme problem areas, but the most important contribution is in terms of conservation and proper use of natural resources. The economics of urban planning, industrial location, taxation, etc., all provide avenues of application to solving environmental problems. An economis specializing in these and other areas is becoming increasingly importa in the planning, implementing, and evaluating of pollution abatement projects and resource conservation measures.

4. Noise

Biophysicist: The biophysicist is trained in biology and physics. He is concerned with the physical principles of living organisms and living cells. He studies the organism's response to such physical forces as heat, light, radiation, sound, and electricity. He frequently uses such highly sophisticated equipment and instruments as nuclear reaction or special electron microscopes to study the effects of radioactive particles on tissue cells, which make the studi tissues visible down to the smallest units.

5. Radiation

Geophysiciat: A geophysicist studies and analyzes the earth's atmosphere and hydrosphere to determine the effect that changing climate, thermal, seismic, radiation, pollution, and electric conditions have on the earth. He may also analyze the structure and compostion of the earth's interior. His studies encompass the origins of glaciers, volcanoes, earthquakes, etc., and from studies of this type, he attempts to determine appropriate water supply, irrigation, and flood control programs. The geophysicist is intimately involved in the cyclical nature of the earth's environment, and based on his understanding of this interaction, he is in a unique position to help contriubte knowledge toward the solution of major environmental problems.

6. Pesticide

Biochemist: Biochemists study all living organisms and their chemical biological processes. They are primarily involved in a research-oriented profession that studies the impact of chemical changes on plants and animals. Biochemists isolate, analyze, identify, and report on the minerals, vitamins, enzymes, hormones, etc., that affect the operation of living organisms. Some specialize in certain types of organic functions such as digestion, breathing, and aging. They can specialize in the study of environmental pollutants on living organisms. The biological or chemical pollutants in air and water as well as those in the soil affect the functioning of most organisms. Biochemists have a primary responsibility to evaluate these effects and suggest remedial action. The work is predominantly indoors, ususally in a laboratory or research facility, and requires considerable concentration, patience, and attentiveness.

Organic Chemist: The organic chemist conducts experiments with substances of which the essential element is carbon, such as paint, rubber, wood, dye, petroleum, etc. The field of organic chemistry includes as one area of specialization the agricultural chemist who conducts research in chemcial problems related to commercial agriculture. His work includes protecting crops against infestation, promoting soil conservation, eliminating soil poisons, developing better and less harmful insecticides, fungicides and rodent poisons.

11. Education and Technology

Educational Requirements: The generally accepted standard of background training to enter the engineering profession is the completion of requirements for a bachelor's degree in engineering. Advanced training is needed in many positions, present and future. Some specialty fields such as nuclear engineering are taught only at a few schools and some only at the graduate level. Entrance requirements for undergraduate work necessitate a high quality of work in high school with courses in mathematics and physical sciences.

1. Aeronautical Engineer: An aeronautical engineer engaged in a career relating to environmental problems is involved in the design and development of aircraft which decrease the amount of air and noise pollution. He usually specializes in one or several phases of work such as testing, propulsion, structural design, materials analysis or similar activities. He is concerned with all aspects of the development of aircraft and related aerospace devices and may specialize in certain types of aircraft - jet, conventional propelle driven, military, or commercial. However, there is considerable flexibility among these specialties that can allow for internal mobi

   An aeronautical engineer works primarily indoors with some study and observation occuring in and around aircraft and their components. T type of engineering is not considered physically demanding. Where the environment is concerned, aeronautical engineers can most effectively use their skills in the prevention or reduction of air and noise pollution.

   Combustion Engineer: The combustion engineer designs heating equipmer that will efficiently burn fuel, then test it in the burning proces He attempts to determine which fuels are best suited for a specific process that will provide optimum resource and minimum fuel consump tion. The combustion engineer works primarily indoors, but can encounter hazards in the course of his activities. The work is not generally physically demanding.

   Minimizing resource usage by efficient burning and energy conversion processes and maintaining a minimum level of air pollution pose a major challenge to the combustion engineer. Consequently, he must perform his functions while being cognizant of pollution and resourc conservation.

2. Water

   Hydraulic Engineer: The designing and construction of large power, irrigation and navigation projects that control as well as use water is the special interest of the hydraulic engineer. He must compute and estimate the flow rate of water and specify the correct type and size of needed equipment. Some hydraulic engineers are particularly interested in the evolution of streams, rivers or open waters by such methods as dredging or digging. They frequently design and bui new or artificial channels for water distribution such as reservoirs canals, dams, etc. Much of their work is done in offices or laboratories but also can involve field work.

Watershed Manager: The watershed manager is responsible for the management and maintenance of the country's large water storage facilities such as reservoirs and aqueducts. One of his prime responsibilities is to monitor and control the water level in the storage facility and to regulate flow rate. He also regulates water flow for flood control and irrigation purposes and determines the degree of release required to maintain flow, pressure, and elevation at specified levels. He regulates machinery and turbine engines in hydroelectric plants, frequently monitoring the meters and gauges and performing minor maintenance and repair work as it is needed.

Another major concern of the watershed manager is the territory from which the water flows. He is equally responsible for the care and maintenance of this area, and sometimes it is necessary for him to patrol it. He not only inspects the equipment located there, but watches for trespassing or illegal use of the area and checks for damage from burrowing animals, rodents, pests, or other wildlife.

The watershed manager controls the chemical content of the water purification-maintaining processes, usually on a day-to-day basis, thus making one of his greatest contributions to water conservation. He often supplies data to supervisory personnel for any problem identification and corrective action.

3. Solid Waste

Landscape Architect: The landscape architect plans, designs, and in many cases supervises the transformation of land areas into useful and attractive sites. He designs the appropriate combination of water, trees, land and structures to facilitiate the intended use of the environment. Efficient use as well as aesthetically pleasing design are his primary goals. Parks, playgrounds, shopping centers, resorts, campgrounds, and the like are all within the domain of his profession. In conjunction with the overall design, he provides working drawings, cost estimates, and necessary materials. He works primarily indoors except for the necessary supervisory activity, usually in the later stages of a project's development.

The landscape architect provides at least two important contributions to the solution of environmental problems: He provides aesthetically attractive areas that reduce visual pollution, and he attempts to use available land in the most efficient and functional manner.

4. Noise

Industrial Health Engineer: The industrial health engineer is engaged in planning, analyzing, coordinating and reporting on health conditio in a plant or industry. He applies the relevant principles of engine ing to analyze and control conditions influencing occupational hazard and disease. He must analyze all conditions involving radiation, dust, fumes, noise, vapors, solvents, gases, etc., that are known or suspected of being deterimental to health. He must suggest or recommend methods of remedial or preventive action. Part of his responsibilities include the supervision of workers engaged in development and maintenance of conditions in compliance with health standards. Occasionally, the industrial health engineer acts as a consultant to a management or governmental body. He works primarily indoors and can encounter hazards associated with processes producing the above types of conditions.

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5. Radiation

Nuclear Engineer: The nuclear engineer is involved with scientific research and its application to problems in the use and controlled production of nuclear energy, and is particularly concerned with the hazards of using radioactive materials in nuclear reactors. He is involved in the design, function, and operation of nuclear reactors, but may also work with jet, steam-turbine, and internal-combustion engines. Some specialize in the processing, disposal, and safety control aspects of radioactive materials. Nuclear engineers are often found in supervisory positions.

The nuclear engineers major challenge is the reduction of thermal pollution in water and the control of radioactive emissions into the atmosphere. He can therefore play a major role in the research and analysis of water and air content. To a lesser degree, some of these engineers are involved in the research and analysis of the effect of some aspects of water and air pollution as it relates to the health of animal and plant life. As a result of such research, some nuclear engineers are actively working to use this knowledge in the designing of safer nuclear equipment and facilities.

6. Pesticide

Agricultural Engineer: An agricultural engineer's work can apply in both areas of pollution control and resource conservation. He is interested in applying engineering principles to obtain more efficient design and use of agricultural equipment, farming techniques, the use of electrical and mechanical devices to farming methods, and the efficient use of soil and water resources. An agricultural engineer usually specializes in one or more aspects of resource conservation and pollution control such as testing, application, research and development production, or management. Depending upon the particular specialt his work can be either indoors or out and can be highly physically demanding. The development of efficient agricultural techniques can result in reduced visual, air, and pesticide pollution and an increase in production output. Conservation of soil and water resources through well-planned irrigation systems, efficient plant cover, and crop rotation are all within the domain of agricultural engineering.

Expanding population and increased emphasis on resource conservation and pollution control are likely to stimulate the demand for agricultural engineers. The increased use of solid wastes as agricultural resources and the rapid expansion of power and energy requirements on modern farms will also add to the overall demand. Therefore, a modest upward growth in employment of agricultural engineers is anticipated.

Soil Conservationist: The soil conservationist is interested in and concerned with the productivity, general management, and alternative practices of soil use and conservation. He studies and classifies various types of soil and determines the soil's capabilities for growing different products and crops. Many soil conservationists identify and analyze problems related to such things as land drainage and use of soils in foundations, roads and other types of constructic and structures. He is frequently requested to supply technical assistance to private property owners such as farmers or ranchers not only in the United States but also in foreign countries. He inspects watershed lands in an attempt to pinpoint possible trouble spots where flooding or other problems are likely to occur. He is responsible for preparing reports with suggestions for preventive or corrective action.

The soil conservationist, as his title implies, makes a direct contribution to all aspects of environmental protection and improveme that are related to soils. His work is particularly important in preventing soil deterioration and in maintaining both functional and aesthetically pleasing ground cover.

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III. Technology

Education Requirements: In general, one to three years of post-secondary schooling is needed to qualify for entry-level positions in this field. The length of time and sophistication of training is dependent upon the requirements and complexity of a specific occupation. Candidates for technical occupations can find courses through technical colleges, vocational schools, military service training, or junior or community colleges. Many engineering, mathematics, and science students, who have not completed college degree requirements can qualify for entry-level positions.

1. Air

Environmental Inspector: (Air) The inspector dealing with various as of our environment, such as air, smoke, water, and waste, is primari concerned with determining environmental purity by using a variety of mechanical and chemical tests. He is guided by regulations and statutes that establish standards for environmental contaminatio He analyzes and reports on the samples and data that are collected. Frequently he makes recommendations for corrective action or reports his findings to appropriate enforcement agencies to instigat legal action (where conditions warrant). He frequently must act in an advisory capacity to an establishment that may be bordering on a violation of standards.

Although most specialize in one area, such as noise or solid waste the environmental inspector is also concerned with the entire environment as it relates to his specialized area. He must be cognizant of and react to changing conditions external to his field of interest. For example, a solid waste inspector must be wel informed on the generation of pollutants and their proper disposal w a minimum amount of deterioration of the surrounding environment. And the pesticide inspector has to be aware of the varying demands placed on the need to control pests yet the equal need to maintain standards fo ecological balance and high quality at all levels.

2. Water

Environment Tester or Analyst: (water) The environmental tester or analyst is primarily concerned with the determination of air, water, or soil purity. He uses a variety of mechanical and chemical tests well as a range of methods and procedures in the determination of th level of contamination. He is particularly concerned with the contr devices used by industry and the effectiveness of these devices. The tester or analyst is generally responsible to the supervisory branch of the industry or agency. In his capacity as a tester, he prepares reports and often suggests methods to improve and maintain air, water, and soil standards.

Most of the testing and analyzing work is done inside a laboratory. The gathering of test data is performed outside. The tester or anal may be occasionally subjected to hazardous conditions, but in genera this is not a significant problem. He often has an opportunity to travel, and in some positions with federal agencies, he may be away from home frequently.

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3. Solid Waste

Environmental Technican: (solid waste) The environmental technician utilizes various techniques, methods, and equipment to preserve and increase the purity of our environment. He is responsible for the monitoring of pollution standards. He is also responsible for the installation, operation, and maintenance of the equipment that is used to monitor systems and to collect samples. Environmental technicians are often responsible for collecting data and making reports, and frequently identify and recommend operational procedures or methods in developing solutions for environmental problems.

One of the most controversial, yet critical, areas in environmental careers lies in the field of population management. Technicians are needed not only in basic population research but also in the development and application of methods that aid in the management and control of the world's population growth. Work in the applied field is vitally concerned with behavior, health, and attitudes of people and the dissemination of birth control techniques and knowledge. A background in social and behavioral sciences and an aptitude for working with people are necessary criteria for selection of this occupational area.

4. Noise

Mechanical Tester: (Test-engine evaluator, sound devices, electric motor, etc.) The role of the test-engine evaluator overlaps that of the environmental tester in that it is concerned with the pollution of the air through the sound and emissions from engines. The test-engine evaluator assembles data collected from testing fuels and lubricants in engines. He is concerned with the analysis of engine exhaust and resultant amount of air pollution. He uses microscopes and precision weighing and measuring devices to obtain correct and accurate information.

The automobile mechanic is probably in one of the most crucial areas of air and noise pollution control. He analyzes, tests, and repairs automobile engines in an effort to keep the mechanism safe and trouble free. The mechanic must remain alert to the fact that a properly operating engine uses fewer resources and emits fewer pollutants.

Other test-engine evaluators are primarily concerned with the noise or sound aspect of engines. The sound tester's work is primarily performed indoors where he operates sound-detection equipment to check for defects in the engines. He looks for problems that could potentially cause defective and noisy engines. He is also concerned with the accumulative noise probabilities inherent in vehicles such as motorcycles, airplanes, and trucks. Contemporary legislation requires increased use of pollution control devices, all of which require close attention by the tester to ensure proper compliance with these laws.

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5. Radiation

Nuclear Technician: (Radiation) The nuclear technician usually works as an assistant to a nuclear engineer. He may conduct tests on nuclear waste disposal methods, write reports and assist in the development of machines and equipment, or monitor the plant facilities and working environment to detect any radiation contamination. He frequently uses complex laboratory equipment in conducting experiment. Some are involved in making drawing and models of equipment under the nuclear engineer's direction.

The nuclear technician is interested in the controlled release of nuclear materials into our environment and particularly in devising and improving measurement tests. Because the development of efficient and effective methods of disposal of nuclear waste materials is vital to the environment, water pollution and atmospheric pollution are the most immediate concerns for the nuclear technician. Generally, such technicians perform their work inside a laboratory and its related nuclear plant facility.

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IV. Application and Operation

Educational Requirements: A worker in this category ordinarily requires on-the-job training. Since technological displacement of such workers is anticipated, persons in such jobs will have brighter opportunities by taking training courses and gaining experience that can be transferrable to other types of work.

1. Air

Incinerator Plant Attendant: The incinerator plant attendant is the functional member of the incineration team. He operates the incinerator under the supervision of the foreman; provides direction and assistance for the weighing and unloading of rubbish trucks; repairs, lubricates, dismantles, and replaces inoperable machinery; and handles recording and collecting fees for incineration activities. He works both inside and out and is exposed to all climatic conditions. His work is typically strenuous and may expose him to a variety of occupational hazards.

2. Water

Water Treatment Plant Operator: An operator of a water treatment plant is responsible for seeing that all assigned plant equipment is operating properly. He works closely with and under the direction of the water treatment plant supervisor. He is responsible for reading, recording, and maintaining the correct chemical balance in the water as it is processed through the plant facility. Operators must be skilled in the practice and techniques of water purification.

The water treatment plant operator performs the vital function of providing the citizenry with pure water. He also could be responsible for maintaining sufficient quantities in reserve or storage areas such as reservoirs. His activities are usually routine and closely supervised but nonetheless are vital components of our ecological system related to water.

3. Solid Waste

Recycling Operator: Salvaging has been an active part of our economy for many years; but with the increasing emphasis upon refuse and pollution, a concerted effort has recently developed to find uses for waste and refuse products. It is anticipated that this trend will accelerate and dramatically grow in the next decade. Persons involved in salvaging and recycling efforts now will be part of the development of new and broader methods in the future.

The operator will determine the types of materials to be salvaged and direct laborers in sorting, storing, and redistributing materials to be recycled. He will inspect materials to determine exact methods of redistribution and designate, according to kind and type, the salvageable material. The operator or foreman will direct the dismantling of large objects (such as airplanes) and will inspect parts, routing reparable objects to repair shops and non-reparable objects to salvage.

4. Radiation

Power Plant Operator: The power plant operators role is vital in several areas of environmental control. He operates the boilers, turbines, generators, and other auxiliary equipment. He is usually responsible for supervising the equipment control device and regulates those that feed the subsystems of the power plant, including the adjustments which regulate speed, voltage, and incoming turbines to coincide with the voltage and power being generated. The power plant operator is also responsible for reporting and recording any malfunctions of the equipment, may recommend replacement of the equipment or installation of updated systems, and can be influential in instigating the use of devices to reduce atmospheric pollution. The nuclear power plant operator will be especially concerned in this area of pollution control.

00066

ACTIVITY 5 Urban Encounter Field Trip

Purpose To acquaint the student with some of our technological advances, problems of pollution connected with it, and possible careers related to the solution of the environmental problems.

Behavioral Objectives:

Student will visit one of the three designated places and analyze the impact the company has on life in Little Rock as measured by his participation in the Urban Encounter and the report to the class.

Materials Needed:

Urban Encounter Guide.

Suggested Instructions to the Teacher:

You will be able to decide where your class will go. The arrangements are being made for them to visit Affiliated Food Stores, AMF and Hoerner, or Little Rock Sewage Treatment Plant. Assign each student a section of the Urban Encounter Guide. He is responsible for finding out that bit of information and reporting to the class.

00067

Worksheet: Urban Encounter Field Trip

A Guide for the Environmental and Economic Analysis of an Enterprise

Section 1. History & Ownership of the Enterprise

A. When did it originate? Why and how?
B. Why is it located in this community?
C. What has been the record of growth? Any events of special interest?
D. Is it an individual proprietorship, partnership, corporation, cooperative, governmental agency, affiliated with enterprises elsewhere?
E. Are there significant problems or developments relative to ownership?

Section 2. Production Activities of the Enterprise

A. What goods or services are produced?
B. What natural resources are used, and where do they come from?
C. How many workers are employed, and what skills are required. (What is the annual payroll?)
D. What capital equipment is needed, and how expensive it it? (What is the amount of capital investment?
E. What management and executive skills are required in the operation of this enterprise?
F. In what ways has automation affected the enterprise?
G. Are there any significant problems or developments relative to the enterprise?

Section 3. Market Activities of the Enterprise

A. What is the annual dollar volume of sales? How does this compare with others in the industry?
B. Where are good or services sold?
C. How are sales and promotion activities carried out?
D. Are sales and promotion activities conducted in a manner which, while encouraging the purchase and comsumption/use of the product, also conducive to conservation practices?
E. Are there any significant problems or developments?

Section 4. Relationship between the Enterprise and Government

A. Are there government regulations or restrictions affecting the enterprise? If so, what level of government? (Local, State, Federal)
B. What services are provided by government to the enterprise?
C. What taxes (kind and amount) are paid, and how are they determined?
D. What problems exist in this area? What can be done to solve them?

Section 5. Relationship of the Enterprise to the Community

A. What contributions does the enterprise make to the community? (apart from normal support of government through taxes, etc.)
B. What does the community contribute to the enterprise?
C. Does the enterprise provide leadership and support in the field of education? If so, how?
D. Are there any significant developments or problems relative to community relationships?

Section 6. Relationship of the Enterprise to the Environment

A. Is the enterprise operated in such a way as to minimize dangers of pollution to the environment? If answer is yes list methods employed. If answer is no, list ways you think the enterprise might improve its operation in order to achieve such a goal.

B. What methods does the enterprise use to dispose of its waste products? (recycling? washed down sewer? Hauled away on garbage trucks?)

C. Does this enterprise produce or market a product which is recyclable? If the answer is yes, does the enterprise have a recycling facility in this community? State?

D. If the enterprise offers recycling does it make the gathering and turning in of the recycling materials easy? Is a good incentive price offered for the used material?

E. Does the enterprise have a good market outlet for the recycled goods?

Section 7. Economic Interdependence and Outlook for the Future of the Enterprise

A. What is projected for production and marketing activities in the future?

B. What are the future resource needs (labor, capital, natural resources, management)? Are employment opportunities bright?

C. To what extent will the growth of the community's over-all economy influence the growth and welfare of the enterprise, and vise-versa?

D. What steps can be taken to improve the growth prospects for both the enterprise and the entire community, should such growth be deemed desirable?

E. To what extent will growth and prosperity for the national economy influence the enterprise?

LITTLE ROCK PUBLIC SCHOOLS
ENVIRONMENTAL EDUCATION PROJECT
FIELD TRIPS

1. No students will be allowed to participate in an off-campus educational field trip until he has returned to this teacher a Field Trip Permission Form signed by his parent or guardian. This signed statement should give the parent's permission for this child to go on the trip and absolve the school and the bonded bus carrier of any responsibility regarding accidents which may occur to the child while on the trip.

2. The students must participate in all planned activities.

-Cut along this line-

(This section to be returned to classroom teacher)

Little Rock Public Schools
Environmental Education Project
Field Trip Permission Form

An educational field trip is planned for your child's class or group to visit _____ on _____ _____ _____
Month Day Year

The pupils will be transported by bonded bus carriers.

I, as the parent of legal guardian, give permission for _____
(Pupil's Name)
to go on this educational field trip and understand that by doing so I absolve the school and the bonded bus carrier, of any responsibility regarding accidents which may occur to the child while on the trip.

_____
(Signature)

00070

FIELD TRIP ROSTER

Field Trip _____ Date _____

School _____ Teacher _____

Students Taking Trip

1. _____ 26. _____
2. _____ 27. _____
3. _____ 28. _____
4. _____ 29. _____
5. _____ 30. _____
6. _____ 31. _____
7. _____ 32. _____
8. _____ 33. _____
9. _____ 34. _____
10. _____ 35. _____
11. _____ 36. _____
12. _____ 37. _____
13. _____ 38. _____
14. _____ 39. _____
15. _____ 40. _____
16. _____ 41. _____
17. _____ 42. _____
18. _____ 43. _____
19. _____ 44. _____
20. _____ 45. _____
21. _____ 46. _____
22. _____ 47. _____
23. _____ 48. _____
24. _____ 49. _____
25. _____ 50. _____

00071

APPENDIX

00072

Name _____ Date _____

School _____ Teacher _____

Pre-Test: Eleventh Grade Environmental Education Unit

Directions. Write your answers in the correct space on the answer sheet. DO NOT WRITE ON THE TEST.

Part A Multiple Choice.

1. About what percent of the typical household garbage consist of paper products? A. 50% b. 10% C. 25% d. 75%

2. One of the most serious water pollution problems facing us today is
   a. oil spills from tankers and off shore drilling.
   b. the use of pesticides by farmers.
   c. silt pollution.
   d. thermal pollution.

3. The largest source of solid waste is
   a. household waste.
   b. industrial sources.
   c. farm and feedlot waste.
   d. roadside litter.

4. Supplying the wants and needs of mankind by means of tools and machines instead of doing things by hand is known as
   a. domestic production.
   b. technology
   c. urbanization
   d. industrialization.

5. Making large numbers of things in a short space of time by using standardized parts is known as
   a. mass production.
   b. standardization.
   c. efficiency production.
   d. recycling.

6. In 1850 the amount of work done by man and animals was 65%. Today the amount of work done by man and animal is
   a. 65% b. 80% c. 2% d. 47%

7. The total dollar value of all goods and services produced during a given period is referred to as the
   a. balance of payments.
   b. Gross National Product.
   c. National Debt.
   d. Economic index.

8. The process by which machines that control their own operations with little or no human help is called
   a. mass production.
   b. standardization.
   c. automation.
   d. mechanization.

9. One of the reasons why the U. S. became an industrial nation is its
   a. natural resources
   b. large population
   c. good transportation.
   d. type of government.

10. Which of the following is an example of an environmental problem created by technology?
    a. food shortage.
    b. increase in wildlife
    c. sewage treatment
    d. energy crisis

11. Net migration refers to
    a. emigration subtracted from the immigration.
    b. immigration subtracted from the emigration.
    c. death rate subtracted from the immigration.
    d. birth rate subtracted from the death rate.

12. ZPG is a(n)
    a. government environmental organization.
    b. organization dealing with population problems.
    c. pesticides.
    d. common pollutant in water.

13. In 1790 few pioneers lived outside the orginal 13 states. By 1970, the most heavily populated area was California. This is explained by
    a. an affluent society.
    b. a westward movement in population.
    c. the GNP
    d. higher immigration on the west coast.

14. The study of water and its movement is called
    a. ecology
    b. meteorology.
    c. oceanography.
    d. hydrology.

15. According to the recent reports, which of the following Arkansas Industries are the greatest polluters?
    a. electrical equipment and supplies.
    b. printing and publishing.
    c. wood and paper products.
    d. furniture and fixtures.

16. Temperature inversions contribute to
    a. water pollution.
    b. air pollution.
    c. solid waste pollution.
    d. noise pollution.

17. The greatest contributor to water pollution is
    a. desalination.
    b. agriculture.
    c. cars.
    d. industry.

18. In the eighteenth century a majority of the colonists earned their living by
    a. farming.
    b. trading among the colonies.
    c. manufacturing.
    d. exporting and importing.

19. Which source of power had the greatest influence during most of the nineteenth century?
    a. electricity
    b. gasoline engine
    c. jet engine
    d. steam engine

20. The amazing growth of cities in the latter half of the 1800's was the result of all the following except the
    a. discovery of new sources of power.
    b. application of new inventions and processes.
    c. invention of the automobile.
    d. expansion of transportation and communication.

21. The trend toward urbanization means
    a. the movement of people from rural areas into the cities.
    b. the movement of people away from cities and into the suburbs.
    c. the movement toward the frontier area.
    d. none of these.

22. In the early years of the twentieth century, American productivity was increased through the use of
    a. the assembly line.
    b. new sources of power.
    c. efficiency engineering.
    d. all of these.

23. More than 50% of the population of the United States lived in cities by the year
    a. 1890. b. 1900. c. 1910. d. 1920.

24. By 1970 people living on farms were approximately what percent of the population?
    a. 40% b. 20% c. 10% d. 6%

25. The factors contributing to the nation's economic growth and abundance include all the following except
    a. natural resources.
    b. the transportation system.
    c. unemployment.
    d. scientific development.

26. In the early 1970's the population of the United States was about
    a. 100 million.
    b. 150 million.
    c. 210 million.
    d. 310 million.

27. All of the following are problems of urban areas except
    a. underpopulation.
    b. traffic congestion.
    c. slums.
    d. pollution.

28. The people who make a study of population trends are called
    a. demographers.
    b. geographers.
    c. anthropologists
    d. technologists.

29. By the early 1970's the gap between the rich, industrialized countries and the poor, underdeveloped nations
    a. was closing because of American foreign aid.
    b. was closing because of the spread of advanced technology.
    c. was closing because of the mass media.
    d. was becoming steadily wider and deeper.

30. Which of the following methods is used to dispose of solid waste in Little Rock?
    a. city dump
    b. sanitary land fill
    c. incinerator
    d. recycling

31. What does the word particulate mean?
    a. that matter is made up of small particles.
    b. to separate something into its component parts.
    c. a type of filter used in water purification.
    d. a type of air pollutant.

32. The goal of pollution studies is to help
    a. increase pollution.
    b.. eliminate pollution.
    c. substitute one kind of pollution for another.
    d. bring pollution within tolerable levels.

33. Concern about air pollution has increased because
    a. the natural processes that purified the air have been destroyed.
    b. mankind pollutes the air faster than nature can purify it.
    c. buildings obstruct the winds which formerly mixed the air.
    d. the amount of air upon the earth is decreasing.

34. The ideal water-purifying system
    a. leaves no impurities in water.
    b. returns water fit for further use.
    c. removes all suspended solids.
    d. uses no chemical purification.

35. Which is the greatest source of air pollution?
    a. internal combustion engines.
    b. electric power plants.
    c. industrial manufacturing plants.
    d. chemical manufacturing plants.

36. If the birth rate in a population is above the death rate, the population will
    a. get smaller
    b. get larger
    c. reamin the same.
    d. flucuate.

Part B: True or False. Write True or false in the blanks on the answer sheet. Do not use T or F or + or -.

37. The most serious pollution problems began in the U.S. after World War II.

38. All technological developments may be considered bad bacause they create environmental problems.

39. More trained technical personnel will lead to the solution of some of the problems created by technology.

40. As early as 1798 Thomas Malthus pointed out the danger in the rapid increase in the world's population.

41. Photochemical smog is the haze created by the huge photographic developers such as Kodak.

42. Effluent is the term used to describe the American Society.

43. Pollution is confined primarily to the Western World.

44. Since oil floats on top of water, an oil spill mainly damages the organisms such as water birds which live on the surface or shore.

45. A sanitarian is one who is concerned about the scientific management of waste disposal.

46. One of the most important factors in determining the optimum population of a country is the quality and quantity of its natural resources.

47. Most of the pollutants that man puts into the atmosphere are the results of the burning of fossil fuels.

48. On a clear and still night, an inversion will typically develop.

49. If the pollution load is low and the pollutants are easily biodegradable, running water will purify itself.

50. Secondary treatment of sewage is largely mechanical rather than chemical or biological.

51. In view of the impending fuel dcarcity, it makes more ecological sense to reuse glass containers than to break them up for remanufacture.

52. In today's world, groups and nations with large populations are assured of a power advantage over those with smaller populations.

53. It is commonly felt today that increased spending on pollution prevention will cost far less than the value of the resulting reduction in damage costs from pollution.

54. If we look hard enough, we can almost always find a technological solution to our ecological problems.

00077

Name _____ Date _____

_____ Teacher _____

Post Test: Eleventh Grade Environmental Education Unit

Directions: Write your answers in the correct space on the answer sheet. DO NOT WRITE ON THE TEST.

Part A: Multiple Choice.

1. About what percent of the typical household garbage consist of paper products? A. 50% b. 10% C. 25% d. 75%

2. One of the most serious water pollution problems facing us today is
   a. oil spills from tankers and off shore drilling.
   b. the use of pesticides by farmers.
   c. silt pollution.
   d. thermal pollution.

3. The largest source of solid waste is
   a. household waste. c. farm and feedlot waste.
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   b. technology d. industrialization.

5. Making large numbers of things in a short space of time by using standardized parts is known as
   a. mass production. c. efficiency production.
   b. standardization. d. recycling.

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   d. Economic index.

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   a. mass production. c. automation.
   b. standardization. d. mechanization.

9. One of the reasons why the U. S. became an industrial nation is its
   a. natural resources c. good transportation.
   b. large population d. type of government.

00078

10. Which of the following is an example of an environmental problem created by technology?
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    b. increase in wildlife
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    d. energy crisis

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    a. emigration subtracted from the immigration.
    b. immigration subtracted from the emigration.
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00079

20. The amazing growth of cities in the latter half of the 1800's was the result of all the following except the
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    a. increase pollution.
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33. Concern about air pollution has increased because
    a. the natural processes that purified the air have been destroyed.
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    c. buildings obstruct the winds which formerly mixed the air.
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    a. leaves no impurities in water.
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    d. chemical manufacturing plants.

36. If the birth rate in a population is above the death rate, the population will
    a. get smaller
    b. get larger
    c. remain the same.
    d. fluctuate.

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37. The most serious pollution problems began in the U.S. after World War II.

38. All technological developments may be considered bad because they create environmental problems.

39. More trained technical personnel will lead to the solution of some of the problems created by technology.

40. As early as 1793 Thomas Malthus pointed out the danger in the rapid increase in the world's population.

41. Photochemical smog is the haze created by the huge photographic developers such as Kodak.

42. Effluent is the term used to describe the American Society.

00081

43. Pollution is confined primarily to the Western World.

44. Since oil floats on top of water, an oil spill mainly damages the organisms such as water birds which live on the surface or shore.

45. A sanitarian is one who is concerned about the scientific management of waste disposal.

46. One of the most important factors in determining the optimum population of a country is the quality and quantity of its natural resources.

47. Most of the pollutants that man puts into the atmosphere are the results of the burning of fossil fuels.

48. On a clear and still night, an inversion will typically develop.

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51. In view of the impending fuel dearcity, it makes more ecological sense to reuse glass containers than to break them up for remanufacture.

52. In today's world, groups and nations with large populations are assured of a power advantage over those with smaller populations.

53. It is commonly felt today that increased spending on pollution prevention will cost far less than the value of the resulting reduction in damage costs from pollution.

54. If we look hard enough, we can almost always find a technological solution to our ecological problems.

Part C: Completion - Discussion. Answer the following two questions on the back of your answer sheet.

55. Give five environmental problems that exist in Little Rock. Give at least one example and one possible solution for each one.

56. List and describe eight careers related to the environment.

00082

U. S. Environmental Problems
Eleventh Grade American History

Pre-Test & Post Test Key

1. a	19. d	37. True
2. b	20. c	38. False
3. c	21. a	39. False
4. b	22. d	40. True
5. a	23. d	41. False
6. c	24. d	42. False
7. b	25. c	43. False
8. c	26. c	44. False
9. a	27. a	45. False
10. d	28. a	46. True
11. a	29. d	47. True
12. c	30. b	48. True
13. b	31. d	49. True
14. d	32. d	50. False
15. c	33. b	51. True
16. b	34. b	52. False
17. d	35. a	53. True
18. a	36. b	54. False

00083

Name _____ Date _____

School _____ Teacher _____

Answer Sheet: Pretest and Post Test

Environmental Education Unit: Grade 11

The answers for parts A and B on the Pre-test and Post Test are the same. No answers are given for Part C of the Post Test since there will be a wide variation of answers from class to class.

Part A.

1. _____
2. _____
3. _____
4. _____
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31. _____
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35. _____

Part B.

36. _____
37. _____
38. _____
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45. _____
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47. _____
48. _____
49. _____
50. _____
51. _____
52. _____
53. _____
54. _____

TALLEY SHEET: PRE-TEST AND POST SCORES

ELEVENTH GRADE AMERICAN HISTORY

SCHOOL _____ TEACHER _____

NUMBER OF STUDENTS IN CLASS _____ DATE _____

STUDENT'S NAME*	PRE-TEST SCORE	POST TEST SCORES			
		PARTS A & B	PART C		
			PROBLEMS	SOLUTIONS	CAREERS
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					

* Please put an asterisk by the names of those students who have had tenth grade biology.

00085

School _____ Teacher _____ Date _____

STUDENT EVALUATION
ENVIRONMENTAL EDUCATION UNIT
ELEVENTH GRADE AMERICAN HISTORY

A. Overall Program

	YES	NO
1. Did you enjoy studying this unit?	_____	_____
2. Do you feel that the unit was worthwhile?	_____	_____
3. Do you feel that you now more about your environment and its problems than you did before studying the unit?	_____	_____
4. Did you increase your desire to want to help in tyring to improve your environment?	_____	_____
5. Did you learn about some actual ways that you can help in improving your environment?	_____	_____
6. Would you like to study another unit about the environment in one of your classes next year?	_____	_____

B. Activities - to what extent did you find the following activities interesting?

Classroom Activities:	Very Interesting	Interesting	Dull
Redwood Controversy Game	_____	_____	_____
Group Research	_____	_____	_____
Class Presentations on Group Research	_____	_____	_____
Careers Day Conference	_____	_____	_____
Films and Filmstrips	_____	_____	_____

00086

Field Trip Activities:	Very Interesting	Interesting	Dull
Orientation before trip	_____	_____	_____
Site Visit(s)	_____	_____	_____
Field Trip Worksheet	_____	_____	_____
Follow-up Activities	_____	_____	_____

C. Materials - Rate the following according to the amount of help they were to you in learning the material in the unit.

Classroom:	Very Helpful	Helpful	Little or No Help
Redwood Controversy Game	_____	_____	_____
Group Research	_____	_____	_____
Class Presentations on Group Research	_____	_____	_____
Careers Day Conference	_____	_____	_____
Films and Filmstrips	_____	_____	_____
Resource Materials (Books, pamphlets, articles, etc.)	_____	_____	_____
Field Trip:			
Orientation before trip	_____	_____	_____
Site Visit(s)	_____	_____	_____
Field Trip Worksheet	_____	_____	_____
Follow-up Activities	_____	_____	_____

D. Suggestions for Improvements:

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School _____ Date _____

TEACHER EVALUATION
ENVIRONMENTAL EDUCATION UNIT
ELEVENTH GRADE AMERICAN HISTORY

A. Overall Program	YES	NO
1. Do you feel that the unit was effective in your class?	____	____
2. Did the activities used in the unit adequately cover the major concepts?	____	____
3. Were the objectives relevant to the concepts and the activities in the unit?	____	____
4. Were the objectives realistic?	____	____
5. Do you feel that most of these objectives were achieved in your class?	____	____
6. Was the material used relevant to the student and his local environment?	____	____
7. Did you have enough time for the unit?	____	____
8. Omitting the time factor, was the schedule easy to follow?	____	____
9. Were the resource materials provided adequate?	____	____
10. Were your classroom facilities adequate for the activities used?	____	____
11. Was the teacher's guide adequate?	____	____
12. Do you feel that your students have become more aware of their environment and its problems?	____	____
13. Can you see any carry over into the student's activities outside the classroom?	____	____
14. Has there been any carry over in other subjects that you teach or that the student's have?	____	____
15. Do you feel that this unit should be continued next year?	____	____

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B. Resource Materials:

How would you rate the adequacy of the resource materials used in the unit? If you did not use an item, write, Did Not Use in blanks.

	Content			Quantity		
	Good	Fair	Poor	Not Enough	Adequate	Too Many
Films:						
Environment	___	___	___	___	___	___
Population and the American Youth	___	___	___	___	___	___
Clean Town U.S.A.	___	___	___	___	___	___
Cycles	___	___	___	___	___	___
People Who Fight Pollution	___	___	___	___	___	___
Filmstrips:						
Beer Can By the Highway	___	___	___	___	___	___
Reference Material	___	___	___	___	___	___
Interrelationshop Information Sheet	___	___	___	___	___	___
Vocabulary	___	___	___	___	___	___
Career Materials	___	___	___	___	___	___

C. Activities

How would you rate the effectiveness of each of the following activities used in the unit?

Classroom Activities	Good	Fair	Poor
Redwood Controversy Game	___	___	___
Group Research	___	___	___
Class Presentation on Group Research	___	___	___
Careers Day Conference	___	___	___

Field Trip Activities:	Good	Fair	Poor
Orientation	____	____	____
Site Visit(s)	____	____	____
Field Trip Worksheets	____	____	____
Follow-Up Activities	____	____	____
Evaluation:			
Pre-Test	____	____	____
Post Test	____	____	____
Student Evaluation Form	____	____	____
Teacher Evaluation Form	____	____	____

D. Comments or Suggestions:

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Film and Filmstrip Summaries

Population and the American Youth

This film is a study guide to the written reports of the Commission on Population Growth and the American Future.

Environment

The causes of the deterioration of our environment are complex and closely bound to the strengths of modern industrial societies: affluence, advanced technology, and individualization. This unusual and dramatic film probes beyond the superficial and rhetoric of ecology and asks what trade-offs are we really willing to make to preserve our environment.

Clean Town, U.S.A. or Cycles

This film shows how Franklin, Ohio is working toward a solution of its problems in solid waste, air polltion, water pollution by using technological development to its advantage.

Beer Can By the Highway

In the filmstrip, the discussion starts with the beer can and moves into a query about the relationship between waste and abundance. This leads in the direction of both evnrionmental values and political science. Along the way, many ideas are added to give roundness to the argument.

People Who Fight Pollution

This film deals with old careers being reidentified and given importance because of our environmental plight and new careers emerging as people recognize some of the environmental problems and work toward their elimination.

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